THE IRON TRADE REVIEW

VOLUME XXIV. CLEVELAND, O., AUGUST 13, 1891. NUMBER 33.

THE IRON TRADE REVIEW.

A JOURNAL OF THE
IRON AND STEEL INDUSTRY, THE MACHINERY TRADE AND KINDRED INTERESTS
IS PUBLISHED EVERY THURSDAY BY
THE IRON TRADE REVIEW CO.,
27, 29 *and* 31 *Vincent Street, Cleveland, Ohio.*

TERMS, (strictly in advance):

One year	$3 00
Six months	1 50
Three months	75

Advertising Rates Furnished on Application.

ENTERED AT THE POST OFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER.

CLEVELAND, O., AUGUST 13, 1891.

THE WEEK IN IRON CIRCLES.

General Features. Seasonable weather continues to prevail throughout the United States, and the crop reports are correspondingly encouraging. Recent estimates place the cotton crop at 8,000,000 bales, wheat at 650,000,000 bushels, oats at 700,000,000 bushels and corn at 2,000,000,000 bushels. Meanwhile the reports of the Russian wheat crop grow more and more gloomy, and the prospect of an enormous foreign demand for American breadstuffs becomes still more apparent. As might be expected, the iron trade is suffering from the usual midsummer dullness, but that it is on a solid basis is evidently shown by the small number of failures, in this line of business, that have been reported during the past six months. Our reports from leading Central Western points show a sluggish pig iron market and no particular change in the monetary situation. At Cincinnati, there have been a few orders of considerable size for pig iron placed, but the bulk of the business has been in contracts from single car loads to one or two hundred tons. Softeners and charcoals continue to drag and accumulate, as do also the lower grades of Southern coke irons. Producers generally have almost given up hope of higher prices this year, and many of them are willing to contract their entire product at about the present range of values. Buyers maintain their indifference and it is evident that a showing of increased consumption or decreased production will be necessary to rouse them from the state of lethargy into which they have fallen. Consumers are wisely co-operating with furnaces in getting forward August and September deliveries to protect themselves against the shortage of cars, and this is decreasing stocks in the South to some extent. Foundrymen, almost without exception, report their margin of profits very small, but settlements are made quite promptly, and there is a feeling of confidence among the trade. Transactions at Chicago during the past week in pig metal have been mainly confined to small quantities, though several sales of Southern coke iron are reported, ranging in size from 500 tons up. Carload orders are numerous, as with here and there exceptions, consumers are mainly covered for their requirements for three or four months ahead and in many cases for entire balance of the year. Lake Superior charcoals continue inactive with various signs of weakness as to price. The car famine heretofore predicted is beginning to prevail all through the South. The demand for rolling stock in which to move crops, is exceedingly heavy and for the next few months it will be impossible for pig iron furnaces to ship with any degree of promptness. The general impression at Louisville and through the South is that there will be considerable activity in all branches of the iron business during the Fall and Winter, though at the moment few consumers of pig seem inclined to take advantage of the prevailing low prices to protect themselves on contracts anticipated a month or so hence, and the consequence is a general hand-to-mouth business, buyers taking only what pig metal they are opliged to have for contracts already in hand. There is really no change in quotations which are nominally on basis of $10 to $10.25 for grey forge, Birmingham, though offers on a less basis for some lots are reported. Midsummer dullness, added to the fact that the reunion of the Grand Army was held in Detroit last week, absolutely prevented anything in the way of business there, locally; and were it not for the demand which came from the East for Lake Superior charcoal iron, there would have been a positive dearth of transactions. It is pleasing to note that this demand for Lake Superior charcoal seems to keep up without cessation, and it shows but slight accumulation of stocks at the various furnaces in this region, Otherwise the market was dull. Business during the past week at St. Louis, has been quite active, several fair sized lots of coke and charcoal irons having been placed. However, the prices at which sales were made were somewhat low. The feeling among consumers of pig iron at Buffalo is better. More work is in sight than for many weeks, or even months; tight money and excessive production are the only drawbacks. Even with these drags to general activity the indications are strongly in favor of August, 1891, far surpassing the same month of last year in volume of business. It is difficult to find any signs of advancing prices, many predicting long continuation of the present market, which has not changed since our last week's report.

The Local Situation. The situation in the iron and pig iron lines is one of absolute stagnation, at least as far as new business is concerned. Nowhere is there a record of any activity whatsoever, and apparently the producers of raw materials are in no hurry to force the issue. Prices are very low, so that there is little inducement to make a market with the assurance of an unprofitable trade. When the first rush was made for new ore, this year, there were some furnaces that held off, trying to cheapen still further the already emaciated quotations, but as time went along, ore experienced a slight advance, and now, with the uncertainty of vessel freights as an additionally perplexing factor, the ore men dare not sell what little there may be to offer, at any price that will not promise to let them out in case of any more flurries in lake freights. The vesselmen, by the way, have experienced a set-back which struck them none the less hard because it was wholly unexpected. With the recent demand for grain carriers quite a good many craft were withdrawn from the ore trade, and diverted into the grain channel, driving up the rate of ore carriage far beyond the legitimate warrant of the market. In such a hurry were they, that in a very few days there was a surplus of grain carriers; and the excess of supply in this respect occasioned considerable cutting in freights, so that the grain rate fell again, and with it the proportionate ore charge. The difference is that while last week nine boats were chartered to bring down ore from Escanaba at $1.10, the market is easy this week at ninety cents, and the vesselmen are anything but pleased at the change the aspect of affairs have taken. The full returns of ore receipts up to August 1, which will be found on another page, fully bear out all that has been said in these columns as to the situation. Shipments, however, are going on now regularly, the delays of the earlier season having been overcome, so that the August receipts may be expected to be very large. The small figure of Cleveland receipts is explained by the long strike of the ore handlers. Pig iron is very dull in price, and there is little demand for any product outside the long-time orders on which the furnaces are now running. What little iron is made in excess of these orders, may be had very cheaply, the best all-lake-ore foundry irons going at about fifteen dollars at the Valley furnaces. There is a marked disposition on the part of the trade to accumulate as little stock as possible, for which reason no efforts are being made anywhere to find new markets, and thus further to weaken prices. Thus it comes that while spot iron, in small quantities, is very cheap, few furnaces will be found to sell at the ruling quotations, either in large quantities, or for anything like long-time delivery. The market for manufactured iron is rather good, and while the price is not high, quotations are firm and the volume of trade is good. A good many mills have sold up their entire output for the remainder of the year, notably in bar iron, while the sheet mills report a very good business and at fairly good prices. There has been no appreciable change in metal prices, the market remaining firm, but sluggish.

LAKE ERIE RECEIPTS OF IRON ORE TO AUGUST FIRST.

From official sources we have collated the following statement showing the receipts of iron ore at Lake Erie ports for the year 1891, up to August 1st; coupled with the condition of the docks at previous dates:

Port.	Receipts Entire Season of 1890. (Gross tons.)	On Dock. Dec 1st, 1890. (Gross tons.)	Receipts Season of 1891. To August 1st. (Gross tons.)
Buffalo	548,000	125 732	179,860
Erie	487,493	248,714	171,834
Ashtabula	2,176,730	1,151,397	580,795
Fairport	1,096,408	721,000	375,451
Cleveland	1,945,492	1,209,467	398,617
Lorain	280,450	210,237	135,030
Huron	1,200	1,200	None.
Sandusky	174,596	115,000	62,441
Toledo	164,295	110,740	94,103
Total	6,874,664	3,893,487	1,998,131

Navigation formally opened on May 15th, this year, but owing to the strike of the dock hands, little was done before the 1st of June. Up to August 1st, therefore, in point of time something more than one-third of the shipping season was over, and very nearly 2,000,000 tons of iron ore had been laid down at Lake Erie ports. Of course it is not to be expected that the remainder of the season will show a proportionate amount of receipts in view of the demands of the grain business for carriers, and the conclusion reached some time since by this paper, that the total shipment of the Lake Superior region would hover about 5,500,000 tons this year, would seem, therefore, to be borne out by the above figures. Of this about 1,500,000 will probably be handled through Chicago, and the balance distributed along Lake Erie ports. As nearly 90 per cent. of the estimated production of this year has already been sold, it will be practically impossible to bring down more than the above estimated amount.

Glancing at the comparative standing of the different ports this year, we find that Ashtabula, as usual, leads, with Cleveland and Fairport neck and neck for second place. Eastern shipments are indicated by the receipts at Buffalo, 179,860 tons, though fully half a million tons of non-Bessemer hematites have recently been sold for delivery east of the Alleghenies.

Taking prices, product and probabilities into consideration, the outlook for the mining companies is by no means roseate.

A GROAN FROM THE COBDEN CLUB.

The twenty-fifth anniversary of the Cobden Club was recently made the occasion of some oracular deliverances that are, to say the least, amusing in the light of the recognized facts of history. As a specimen of dogged, so-much-the-worse-for-the-facts determination not to yield to the inevitable, the annual report of the Secretary (Mr. Richard Gowing) is a study, in its way. Some facts are too patent to be passed over, even by the Secretary of the Cobden Club, but they are 'mighty few in number. Here is one: "The Cobden Club," he says, "is often challenged with the fact that many of the principal countries of the world are becoming more Protectionist, and that the prospects of universal Free Trade do not improve." "Unquestionably," he adds, with a sudden rush of frankness, "a wave of economic reaction has lately been passing over the nations." We would say so! With Germany joining the United States, and Russia joining France, and Italy joining Belgium, and New South Wales and Victoria sending greeting to Canada, it looks as if the "wave of economic reaction" was about to engulph everything except the hide-bound adherents of the Cobden heresy. But a crumb of comfort is found in the fact (assumed, of course) that "a very large proportion of the most competent and best qualified thought and opinion, in the midst of the countries and colonies dominated by protection, is on the side of Free Trade." We are quite sure the able and distinguished truth-distortionist of the New York *Evening Post* will take that all to himself!

The report goes on to say that the committee has watched with great interest the movement for Imperial Federation carried on by Sir Henry Parkes in Australia, and it looks to him to carry out a movement that will help forward the cause of Imperial and universal Free Trade; but it fails to add that Sir Henry Parkes and his Free Trade Government have recently gone down in overwhelming defeat at the polls, and that Protection is decidedly on top in the Australasian colonies.

The able president (Mr. Thomas Potter, M. P.) took comfort in the thought that, during the twenty-five years of the club's existence, it had circulated upwards of two millions and a half of books and pamphlets and fourteen million and a half of leaflets, but notwithstanding this great outgoing of Free Trade thought, he was compelled to admit that "the reports from foreign countries, in America and Europe, were not satisfactory," yet he still thought there was "a dawn in Europe." The club had received letters from Germany which gave them hope that ere long the movement of the Free Traders in the German Parliament would be crowned with success. They had also heard from Italy that there was an inclination towards Free Trade and towards the development of their commercial system in the direction of the policy which England had so long adopted. At the same time, he adds, it would not do to be too sanguine, to hope for great things. All that they had to do was to stick to their own fiscal system, under which unexampled prosperity had been secured to Great Britain, and other nations might judge of their example, and must work out their own deliverance from the protectionist system. That is it. Stick to your theory through thick or thin, though the facts against it are piled mountain high—that is the creed of the average Free Trader throughout the world.

MANUFACTURERS AND THE WORLD'S FAIR.

Some of the latest news concerning the World's Fair is of especial interest to manufacturers. Chief in importance is the announcement that the principal trunk lines in the United States have agreed to transport exhibits at half the usual rates. This reduction is made by the different traffic associations. It applies to every class of exhibits except fancy horses, cattle and other high-priced animals. The latest traffic association to grant the half rate is the Trans-continental, an association that embraces all lines West of the Mississippi river. Similar action has already been taken by the Western Traffic Association, the Central Traffic Association, Trunk Line and New England Association.

Ohio has been honored by the selection of Mr. James Allison, of Cincinnati, as Chief of the Department of Manufactures. Mr. Allison is a prominent manufacturer well fitted by training and experience to fill this important position.

Among the unique exhibitions in the machinery line will be that of the New Orleans Machinery Company, which will make a complete exhibit of cotton gins, sugar mills and other machinery. Another interesting invention that this company will bring is the first cotton gin made by Eli Whitney, which was invented some time in 1790.

American manufacturers are proverbially enterprising, and there is no doubt that the display of our manufactured products will be all that could be desired, justifying the London *Times*' prediction that the Columbian Fair will surpass in some respects all exhibts previously made.

PUSHING FOR PAN-AMERICAN TRADE.

Whether the Pan-American Transportation Company is a myth or not, the object which it seeks to attain, *i. e.*, more intimate trade relations with South American republics, is by no means chimerical. According to the daily press, the capital stock of the company is $10,000,000, with the privilege of increasing it to $100,000,000. One million dollars is to be paid in before operations commence. Among other objects of the company will be to construct at first twenty steel steamships and to have at least eight lines in operation to various South American ports within three years. The last of these must be in operation by that time under the provisions of the act, but it now appears that the first move of the company will be to purchase second-hand ships of the second-class, a portion of the first $1,000,000 being used for this purpose. It will afterward be decided whether to construct any of the first-class or not. It is stated that Galveston and Tampa will be the ports for three steamship lines each, and New Orleans and Mobile for at least one each. The company has as yet made no arrangements for entering the South American ports, but says it intends to send representatives there for that purpose. The charter is a most liberal one and gives the power to construct, buy and operate railroad, cable, telegraph and telephone lines; to receive subsidies, concessions and gifts from Governments, States, municipalities and individuals.

SPURIOUS PROTECTION.

Thus far, ex-Congressman Niedringhaus is the only tinplate manufacturer in the United States, present or prospective, that believes that the importation of Welsh tinplate workers is essential to the establishment of the industry in this country. His challenge has been promptly met by the Amalgamated Association, which has instituted an inquiry as to the number of skilled tinplate workmen

now in this country; and, although the results have not yet been published, enough is known to justify the claim that Mr. Neidringhaus himself will be compelled to readjust his views. The hasty decision of the Treasury Department, that the immigration laws do not debar the importation of skilled labor for an industry not yet established, is hardly consistent with common sense, whatever the legal aspects of the case may be. The fact is, that both Mr. Niedringhaus and the Treasury Department, whether wittingly or not, have placed a first-class weapon in the hands of the opponents of American tinplate, and the sooner they recede from their position the better. The spirit of American Protection is to build up new industries through the employment of American labor; anything that calls itself Protection and ignores this very plain and common-sense proposition can be safely set down as the spurious article.

PETROLEUM fuel is rapidly advancing in the estimation of manufacturers and engineers. Probably the largest limestone company in the United States has crude petroleum in daily use in its kilns, with satisfactory results as to convenience and economy. The latest suggestion is that oil fuel be used on torpedo boats. Liquid fuel, in proportion to its bulk and weight, has great evaporative power, and a modern torpedo boat which could cover 4,000 miles with coal fuel could steam 7,000 miles by the use of the same weight of oil, thus nearly doubling its sphere of action. There are other advantages, such as the perfect combustion of the oil, thus preventing the formation of residuals and smoke; also the greater maneuvering capacity of a vessel to be attained by the possibility of suddenly increasing, reducing or stopping the fires under its boilers. The Naval Intelligence Office has arrived at the conclusion that it is quite possible that England, Russia and the United States may decide to use oil for torpedo boats at least.

WHAT of the steel rail market? As to the present, it is as dull as dullness itself. As to the future, everything is problematical. The horoscope of the *Iron Age* reveals this: "Some hope for a revival in the Fall. Others believe that the Spring business, which is expected to reflect the results of the crops, will not come upon the market until February or March of next year. Thus far the outlook for Fall and Winter work is very discouraging indeed, and some makers have practically made up their minds that they have very little to expect. Railroad managers have no inducement to place orders for distant delivery, even if they saw their way clear to pay for the rails. They know that the price is not likely to advance materially. The good crops will bring the roads money, but the first object to which many of them must apply it will be to pay back what they have borrowed. It is pointed out, too, that railroad managers are not likely to make extensive renewals while their roads are taxed by traffic."

HERE is a frank admission and a strong argument for the establishment of a tinplate industry in this country, all in one sentence, taken from the London *Economist*: "What is patent to the meanest understanding is that to successfully compete with any American firms who may take up the manufacturer our makers must *cut their prices*; and further the Americans will not put up with any such cornering process as the home makers are now indulging in."

ALUMINUM is now selling on the market for 50 cents per pound. Two years ago the price was $2 a pound. As to price aluminum is now on a par with copper. The world moves.

"BLUE BLAZES," BOILING, ETC.

BY JOSEPH CORNS.

I am always pleased to read the early experience of those who were engaged in the making of iron in the years of the '30's and '40's, and who are still among us to tell it—much more so than to read of it in books written by those who have had little or no practical experience. I read with pleasure the articles of Messrs. Jacob Reese and Wm. H. Powell, both of whom the writer was personally acquainted with in years referred to. The article of the former is somewhat misleading when he says that his father introduced boiling in this country in 1833. I have no doubt about his father introducing puddling in the locality named and at the time specified, but have never heard of any person claiming the introduction of boiling until it was done by the late Edward Nock, who died in Youngstown, a few years ago. It is my recollection that he introduced it at what was known in Pittsburgh, Pa, as the "New Mill," now "Painter Sons," and if I am correct, about the year 1841 or 1842. Mr. John I. Williams, now of Youngstown, could no doubt give the year, as he and I were then learning our trade (shinglers) together, under the direction of his father, at the said "New Mill." We doubtless do, and always will remember the change from plate or pig metal *dry* puddling to boiling, as we were then brought into close quarters with the flying cinder from the balls of the boiling furnaces. The "Blue Blaze" cure would be of no service to the shingler in that case. Fine charcoal on the anvil under the ball was preferable. We have known puddled balls hammered with plain shoes and little or no leggings, but no boiling balls were approached with that familiarity; and further, we were not troubled with balls boiled, flying all to pieces, as in the case of the dry puddled balls. A few things had to be carefully observed in dry puddling to avoid the destruction of the ball. One was getting the ball too hot all through, making it necessary to throw water on it to cool it quickly. The "Blue Blaze" referred to would then appear, but they would show themselves on a ball that was too cold about as readily, and would only aggravate the danger of the ball going to pieces. Another was that no raw or imperfectly worked iron found its way into the center of the ball. A further difficulty was in regard to the lumps and cakes. As they had a bright and a dark side, care had to be taken that the bright sides were put together in the formation of the ball. Then a knowledge of the quality of the different brands of iron, such as weak and strong irons, and so forth, was necessary, a lost art now.

My aim in this is to give Mr. Nock the credit of introducing the boiling process in America. To him, I believe, it belongs. The chemistry of different processes I will leave to those who understand it—I do not.

MASSILLON, O., August, 1891.

THE SHORT CUT IN STEEL ROLLING.

Attempts have frequently been made by American steel manufacturers to avoid the use of the blooming mill or ingot hammer. Thus far, however, the only works to our knowledge in which it is done successfully in this country are the Atkinson Steel & Spring Works, at Harvey, Ill. These works have not merely experimented with the process, but they are now making their entire product in this way, and have been doing so for several months. Difficulties were encountered at the outset which were pronounced insurmountable by practical steel rollers of long experience, but the pluck and perseverance of the President of the company, Mr. F. M. Atkinson, and the untiring efforts of his very capable mill staff, overcame all troubles, and the process now seems as well established as the regular method of hammering or blooming large ingots into billets before rolling into bars.

These works were formerly known as the Atkinson Car Spring Works, and for years were located within the city limits of Chicago. Spring steel was purchased from steel manufacturers. Last year the company decided to manufacture their own steel stock, and having secured a site at Harvey, proceeded to erect open-hearth furnaces and a rolling mill. When this part of the plant was completed, early in the present year, the spring shop was removed to the same location. In erecting the steel works, President Atkinson determined to avoid the heavy investment of capital required for the erection of the blooming mill, and arranged for casting small ingots of billet size.

The production of steel has hitherto been limited to the output of a single 15-ton Siemens-Martin furnace, but the company have just erected another 15-ton furnace of the Swindell pattern, which will shortly be put in operation. Ingots are cast in a semi-circular pit. The ladle is supported on a truck which in turn rests on a framework pivoted at one end on a pillar in the center of the pit and at the other end runs on wheels on a rail which skirts the edge of the pit. The ladle can thus be shifted easily over the whole area of the pit. The molds are set in the pit in groups of 30, with one pouring hole for each group. A heavy cast-iron plate, with gutters running from the center to the ends, forms a base for each group. The metal enters each mold at the bottom, filling the entire 30 molds simultaneously. At present 150 ingots are cast with one ladleful of metal. The ingots are usually four inches square, sometimes five, and about three feet long, weighing about 200 to 250 pounds each.

The casting pit is further served by a crane of excellent design. This crane is operated by steam power, swings in a circle, hoists, lowers, etc., at the touch of the lever, and is especially serviceable in the rapid work required of handling so many ingot molds in and out of the pit for three heats daily. The ingots as cast here are high in carbon, being exclusively intended for springs, and by the patented process adopted in the casting are remarkably free from blow holes and piped ends. The rolling mill used is simply a train of 12-inch three-high rolls, such as would be required for breaking down and finishing billets. The ingots are heated in a gas furnace with four doors, care being taken not to get them too hot. They are then rolled into rounds ranging from 1½ inches in diameter to ½ inch, according to the requirements of the spring shop. Flats can be and are, however, rolled equally well. The bars rolled in this way will bear the closest inspection, notwithstanding the defiance of ancient methods in steel-rolling practice. They are free from flaws and well surfaced. When coiled into springs they endure the rigid tests applied with a remarkably low percentage of failures, showing better results in that respect, according to the records of the company, than when they were running on purchased steel. Due credit must, of course, be given in this connection to the steel-melting department, where a mixture is made with special reference to the requirements of the railroad spring trade. But the steel certainly would appear not to be impaired in quality by the short cut taken in rolling.

The spring shop of the company is fitted with helve hammers, coiling machines, shapers, etc., and is served by a separate gas heating furnace. The spring shop, at present, is hardly equal to the capacity of the steel works, but improvements are being made which will when completed, test the capacity of even the enlarged steel plant.—[Iron Age.

PENNSYLVANIA makes 52 out of every 100 tons of rolled iron in the United States, and 69 out of every 100 tons of steel rails.

LAKE SUPERIOR MINING NOTES.

The Pittsburgh & Lake Superior Iron Co. has resumed explorations with a diamond drill west of the store and where the existence of a considerable body of ore was proven last year at a depth of 600 feet from the surface. Present work will be confined to more definitely declaring the extent of the deposit and in the hope of catching it nearer the surface.—[Negaunee Iron Herald.

The work of sinking the shaft at the U. S. Grant, now down 200 feet, is being pushed by every effort consistent with reasonable economy. The shaft is at present bottomed in an ore of fair quality, though the company have decided to sink 100 feet more before commencing the work of drifting. It is the general opinion that the Negaunee mine deposit will be reached before this additional depth is attained.—[Negaunee Iron Herald.

Ridiculous reports have been circulated regarding the loss at the Republic mine occasioned by the recent fire. Some reports place the damage at $250,000. The actual facts are that the damage will not exceed one-tenth that sum, and is probably not that much.—[Iron Range.

The biggest sinking on record at No. 2 shaft of the Hamilton was 92 feet for the month of July. Some of the men at the Hamilton have made a wager that 100 feet of sinking will be accomplished this month.—[Iron Range.

The Florence has temporarily ceased its shipments, all regular trains being "hauled off" yesterday. Nearly all its Eagle or second-class ore has been shipped, but the mine has some 50,000 tons of first-class (Florence) ore in stock, but no sales of the product have yet been make.—[Florence Mining News.

Vermilion range ore shipments from Two Harbors for the season, as reported by the Superintendent of Docks, up to Wednesday noon, August 5th, are as follows:

	Tons.
Minnesota	238,075
Chandler	165,058
Total	403,133

The Vermilion is this season shipping ore with greater activity and dispatch than any other Lake Superior range. And to the low water at the "Soo" canal is due the failure to even increase the present heavy shipments, the Mariska, Mesaba, Manola and Marula being compelled to clear with from 200 to 300 tons less than was regularly carried last season. But in spite of all this July proved the banner month in the history of the port of Two Harbors, and the shipment was 25,060 tons greater than July, 1890. Although shipments commenced very late in consequence of the depressed iron market, the unprecedented dispatch which has characterized shipments has caused the figures to nearly reach those of a year ago. The clearances for July were an even hundred. The grade shipments for the month, as given by the Two Harbors *News*, are:

	Tons.
Minnesota	53,132
Soudan	30,325
Vermilion	21,458
Red Lake	12,001
Chandler	61,878
Long Lake	5,238
Total	184,032

We repeat that a district that is making such a record in this off year has either very desirable ores or the mines' management is most excellent—or both.—[Vermilion Iron Journal.

Ore freights have advanced just 100 per cent. within the past three or four weeks, carriers now demanding $1.10 from Escanaba against 55 cents asked a month ago, the rates from Ashland and Marquette of course undergoing a corresponding raise. The cause for this remarkable increase is owing to the movement of the grain crops, and will likely be maintained throughout the present shipping season. As a consequence, however, of the big advance, many mines in the Lake Superior district, including eight on this range, have temporarily suspended shipments, the Iron River being one of the number. Owing to the limited demand for pig iron, the furnaces cannot afford to pay larger prices for their ore than they have been paying, and the mines, on the other hand, certainly cannot sell their products for a less price than they have been receiving. Many mining men believe this state of things, however blue they may look at present, will be a good thing in the long run. A big falling off in the estimated season's output would almost guarantee the working off of the 1890 stocks now on hand at the Lake Erie ports, thus naturally making a good demand for Lake Superior ores next year, which would be a good thing for the small mines as well as the big fellows. The few mines which secured season charters for 65 cents are just now in the swim, but the number of lucky ones is quite limited. In the meantime, most of the mines who are forced to suspend shipping, will continue stocking and developmental work with a view of making good output records next year.—[Florence Mining News.

Straightening Tempered Steel.

It is well known that files are not usually drawn after being hardened, and that the hardening frequently springs them out of line. But notwithstanding that the files are made as hard as they can be by heat and cold water, they are readily straightened after being hardened. This operation is performed at once, as soon as the files have been dipped. The files are taken from the bath of melted lead and chilled while red-hot in a tank of running water. This immersion for the instant hardens only the surfaces, while the interior is soft and pliant with heat. At this time the file may be straightened by bending over and under bars. By similar means crooks in steel arbors, reamers and other long tools may be removed, even after they have been hardened and tempered. A cast steel saw arbor had received an offset or crook in the journal at one end just inside the shoulder. The crook was at the worst end, that next the saw, and, although scarcely perceptible to the eye, when the arbor was turned on its centres, it was sufficient when the arbor was in the boxes to throw the periphery of a 2-ft. saw considerably out. The arbor at the bearing part was very gradually heated, not enough to change color, but a "black heat." A V-shaped block was placed in a vice bearing against the offset side of the journal, and the vice screwed up. At a third trial the arbor came out perfectly true. A contemporary says a tempered reamer was straightened in the same way, the point at which it was crooked being heated by an alcohol lamp. The heat was sufficient to allow the steel to give, but not enough to start the temper. Steel that has a blue temper only may be straightened by blows with a peaned hammer on a smooth, clean anvil, the face of which should be warmed enough to remove the chill.

LONDON'S EIFFEL TOWER.

Sir Edward Watkin is making steady progress with what is, curiously enough, described as "London's Eiffel Tower." Should it not be the "Watkin Tower?" That point, however, may be left to the future. What we are at present concerned with is how far his idea is being carried out. Last year the company formed for the purpose obtained sixty-eight designs for a monster tower. Most of the authors had taken the Eiffel structure for a pattern; others indulged a love for the grotesque, and many had sent in plans which contemplated the expenditure of two or three million pounds. Ultimately the first and second awards were given by the judges to Messrs. Stewart, Maclaren and Dunn (one civil engineer and two architects who had collaborated), London, and to Messrs. Webster and Haigh, Liverpool. Next the question of site had to be considered, and Wembley Park, an undulating, finely wooded, and picturesque estate of 280 acres occupying the high land between Willesden and Harrow was acquired by the Tower Company. The directors have promptly commenced to carry out their plans. A station has already been made by the Metropolitan Railway, whose Harrow line runs across the southern end of the estate. Only 120 acres of the estate are to be used for the purpose of the new pleasure resort; another 128 acres at the eastern side of the estate will be devoted to building purposes, and the rest will be required for railway accommodation. Mr. Firbank is the contractor for the buildings and the foundations for the tower. This is to be erected on the highest point of the park, 170 feet above sea-level, and as the tower will be 1,000 feet high, it will have an advantage of nearly 200 feet over Mr. Eiffel's work. The style of the tower will be a compromise between the two prize designs before referred to. It will be built of steel, and will cost about £300,000. There will be three hydraulic lifts, one going direct to the summit in about 2½ minutes, and the others stopping at the two intermediate platforms. A good deal of work has already been done at the foundations. The tower will spring from the sides of a square 250 feet each way, each side consisting of four separate blocks of cement concrete, built in the form of a cross, and of a depth of 25 feet. In this concrete the cast iron anchors of the tower will be embedded. Of course, in this, as in every other detail of construction, solidity and safety will be the principal considerations.—[Iron and Coal Trades Review.

Decline of Natural Gas Pressure.

The following concerning the different gas fields of Western Pennsylvania speaks plainly of the decline in pressure and supply of natural gas in this district. From it will be noted the fact that the pressure cannot go down much more without practically failing, or in other words, be too light to force the gas to the point of consumption, requiring as is already practiced by one company operating in the Murraysville field, the use of pumps to force the gas through the lines at a suitable pressure.

At the Murraysville gas district the average pressure at the outset of developments in 1886 was 540 pounds. In January, 1889, it was 240 pounds, and in June of this year, it had fallen to 40 pounds.

At the Grapeville district the average pressure at the outset in 1887 was 540 pounds. In January, 1890, it had fallen to 220 pounds; and in June 1891, to about 40 pounds.

The Bellevernon district from which much was expected at the time when the Philadelphia company, at great expense, laid a 30-inch pipe line to tap it, is reported to be about petering out. The Canonsburg district has maintained a higher pressure than any other district, it being now about 125 pounds, having fallen from 450 in 1886. But the gas in this field has not been used as rapidly as in the others. In the six months since January, 1891, the gas supply of the Murraysville district, has fallen from 80 pounds to 40 pounds.

In consideration of the above facts, the time when either coal or artificial fuel gas must be used in many places now supplied with natural gas, would not seem to be far off.—[American Manufacturer.

Wrought Iron and Steel Mains That Stand Enormous Pressures.

Recent mention of the use of riveted steel pipes in place of cast iron for the new water supply main at Newark, N. J., brings to mind several other instances in which light riveted pipes have been similarly used with excellent results. These pipes have been in use in the West for many years, chiefly in cases where extreme high pressure existed.

One of the largest pipe-lines of this character is the 44-inch main of the Spring Valley Water Co., which supplies San Francisco with water.

In 1872 a 11½-inch riveted wrought iron pipe was laid in connection with the water supply of Virginia City and Gold Hill, Nev., and at one point this pipe has had to stand the pressure of a head of 1,720 feet.

Another interesting case is furnished by the recently completed water works of the city of Pretoria, in the Transvaal Republic, South Africa. The water is brought from a spring yielding 5,000,000 to 6,000,000 gallons daily, and there are 50 miles of mains, consisting of thin lap-welded steel tubes, 18 inches in diameter. As bullock carts furnished the only means of transportation, it was out of the question to use heavy cast iron pipes.—[Philadelphia Record.

THE COMMERCIAL PRODUCTION OF ALUMINUM.

The commercial production of aluminum is no longer an experiment, and tons of it are now made for each ounce of a few years ago. It has long been known that this curious metal is one of the most plentiful in nature; but, owing to the difficulty in separating it from its combinations, aluminum has been classed among the precious metals. With the invention of the Cowles' process of electric reduction, and its further improvement by the Pittsburgh Reduction Co., the price has fallen to less than one-tenth of the current rate prior to these inventions. The output of metal increases rapidly and constantly with its appreciation by manufacturers. The present capacity of the plant at Pittsburgh, Pa., is limited to 550 pounds per day at 24 hours, but extensive additions will soon increase this quantity. The process of its production is as interesting as peculiar, and is a perfect parallel to the electro-lytic deposition of metals from an aeqeuous solution of their salts. The ore to be reduced is an imported oxide of aluminum, and the medium for the solution and electric current is a melted triple fluoride kept at a red heat by its resistance to the current. Both poles are of carbon—the negative being a carbon-lined iron tank, and the positive a series of iron rods tipped with carbon, which is consumed gradually by the negative element of the ore. A curious feature of the process is the constant character of the fluoride bath, which remains unchanged no matter how long used. Only a moderate pressure of ten volts is required to break the chemical union, but the quantity of metal deposited is directly proportioned to the amperes of current. This company's commercial success is dependent in a great measure on their ability to run the plant continuously for a long time in the near future to run for a year without a stop. Fig. 1 conveys a clear idea of the construction and arrangement of the reducing baths. Fig. 2 is a view of the interior of the company's power-room from a photograph.

FIG. 1.—ALUMINUM REDUCING BATHS.

Extinguishing Fires by Electricity.

A correspondent of the (London) *Electrical Review* writes: "An improved plan of extinguishing fires by employing a water system governed by electricity has been announced. The inventor is H. Lutkin, and perfected, as there is reason to believe that it will be, this plan will doubtless soon become popular, especially amongst those classes of trade which involve large shops, warehouses, mills, etc. The systems of automatic sprinkling which are in vogue are open to some objections which are obvious to those who have ever had the necessity of testing them in those circumstances for which they are specially designed. Lutkin proposes to introduce an important modification which is calculated to remove the most serious of these objections. His modification comprises the use of a motor and pump, and a complete system of "sprinkler" pipes. These pipes are suitably arranged in every part of the building which it is desired to protect. There is in connection with this system a large number of "push buttons," so as to be as handy as possible, and these start the motor and pump and open any valves which may be requried for extinguishing the fire. It is believed that the instantaneous control of large masses of water thus gained by adopting the system, together with the power to localize the flow of the water, will materially increase the ease and certainty with which fires may be extinguished. So much has been said in certain quarters lately with regard to fires having been started by faulty electric light wires, that an invention like the above, in which electricity may be employed for rapidly extinguishing fire, is certain to be warmly received by all those who are interested in dispelling prejudice and correcting erroneous opinions concerning the safety of the electric light.

FIG. 2.—POWER ROOM OF THE PITTSBURGH REDUCTION CO., PITTSBURGH, PA.

Recognizing the single-acting principle of the Westinghouse engine, as best suited for their purpose, they have installed two Westinghouse high-duty compound engines at 200 horse power each, which drive two Westinghouse shunt-wound dynamos in multiple arc, each generating 2,500 amperes of current of 50 volts pressure; also, one Westinghouse standard 125 horse power engine, driving two Westinghouse shunt-wound dynamos in multiple arc, each generating 1,000 amperes of current of 25 volts pressure. In the short time that this company has been organized a four-months' run has not been uncommon, and it is quite probable that the machinery will be called upon in

NICKEL PLATE Excursion August 17th. Ninth Annual Niagara Falls Outing. Chautauqua Free. Toronto $1 00 extra. Liberal limits. Stop over to visit friends granted on return trip at Brocton or points west. Enquire of Nickel Plate Agents.

THE AMERICAN OIL GAS MACHINE

The American Oil Gas Machine was designed to accomplish the process of charging air with atomized liquid hydro-carbon in definite proportions, and under such conditions as will secure an intimate combination of both, and thus produce a fuel gas that will not disintegrate when stored in a "holder" or in the conducting pipes, but will remain a homogeneous and "fixed" gas.

The feasibility of devising an apparatus for this purpose was suggested by the following considerations:

1. Air will carry a certain amount of water and hold it in suspension (as moisture), which becomes visible as mist or clouds when present in larger proportion.

2. The specific gravity of oil being less than that of water, the air can carry a larger proportion of it.

3. The evaporation of liquids is rapid in proportion to the height of temperature to which they are subjected, and their vapors condense under reverse conditions.

4. If then, that proportion of any liquid which the air can absorb and carry at a certain temperature, is ascertained, air charged with that ascertained proportion of evaporized liquid, will hold it in suspension, provided the temperature is not lowered, and if subjected to a higher temperature, the combination becomes more intimate.

5. Compressed air will not readily absorb liquids, but rather repels them in proportion to the pressure applied, but, whatever proportionate amount of liquid can be absorbed by the air under a certain pressure, will be readily held in suspension when that pressure is removed or lessened.

6. The expulsion of moisture, that is water, from the air, will increase its affinity for vaporized oil.

These facts lead the designer to believe in the practibility of devising an apparatus which would produce a practical fixed oil gas by purely mechanical action, and the machine herewith shown, it is claimed, has abundantly proven the correctness of the theory. The apparatus charges the air with that definite proportion of atomized oil which it will firmly hold in suspension, for an indefinite time, and under all ordinary changes of temperature. The combination is formed under the most unfavorable conditions of pressure and low temperature, is then partly released from these conditions, and allowed to expand under higher temperature and the result is a perfectly homogeneous and permanent mixture, answering every purpose of a fixed gas. It is due to experts in gas to say that this is a fuel, not an illuminating gas, as commonly designated, and that its excellence as an illuminant, is due to the ingenious invention of the "Welsbach Incandescent Lamp" in connection with which, however, it is a first-class and cheap illuminant.

This process is perfectly automatic. The gas is produced as needed without care, attention, or labor of any kind, except the filling of the oil storage tank from time to time, and the lubrication of the air compressor. The generating apparatus occupies a floor space of six by three feet and is ten feet high. Its capacity is from 8,000 to 10,000 cubic feet of gas per hour, which is equal to from 4,000 to 5,000 cubic feet of the best coal (city) gas in heating power. For fuel to supply furnaces for melting, annealing, forging, etc., no holder is needed, though preferable under certain conditions, and especially for illuminating plants. In this machine the oil is disintegrated by contact with a powerful stream of air, supplied from a positive blower or air compressor, which enters through the bottom of the "generator." The resulting spray is driven successively through a number of compartments closed by perforated discs, the holes in which are graded in fineness upwards, each hole or perforation acting as a spraying tube, and this "spray" becomes finer and finer until the topmost disc discharges only a homogeneous mixture of air and atomized oil. The violent atomizing of the oil produces intense cold, and the moisture contained in the injected air is condensed and frozen into small bodies of ice which return with the oil that does not pass from the generator as gas, to a tank below it, where it melts and deposits as water. The desired pressure in the generator, and the proportionate supply of oil, are maintained by self-acting devices. The oil fed into the generator never leaves it except as gas, unless the oil is below the required specific gravity and contains insoluble matter. The oil returning from the generator unconverted is re-subjected to the spraying process constantly in endless rotation, until converted. The returning oil only comes in contact with the fresh air injected, while fresh oil which is fed into a separate compartment, replaces the oil converted into gas.

FIG. 1—MUFFLE FURNACE NO. 2½.

FIG. 2—TEMPERING FURNACE FOR HEATING STEEL PLATES IN CYANIDE.

The process has been in constant operation at the factory of the American Gas Furnace Co., at Elizabeth, N. J., since October, 1890, and the first complete oil gas plant on a larger scale was completed April 30, 1891, for the Crescent Watch Case Co., near Roseville Station, Newark, N. J. The results established by practical use of the gas are as follows: Oil of a specific gravity of 71, costing in tank car delivered at Roseville Station, Newark, N. J., six cents per gallon, will make gas at the rate of five gallons to the 2,000 cubic feet, which are equal to, or exceed in heating power 1,000 cubic feet of the best coal (city) gas. The gas is of the best possible quality for mechanical purposes, producing a minimum of oxidation. For illumination with Welsbach's incandescent lamps, the manufacturers warrant the following statement: Forty lamps of 80 candle power each require 1,000 cubic feet of gas costing for oil 15 cents. We

illustrate four forms of furnaces used by this process. Fig. 1 shows a Muffle furnace. Fig. 2 shows a tempering furnace for heating steel plates in cyanide. The iron tempering pot is flanged so as to suspend it in the middle of cylindrical body of the furnace. The two opposite burners, B, B, inject numerous jets into the space between the furnace lining and the pot, and heat it evenly from top to bottom without striking it. The lighting holes are closed after the furnace is in operation, and the products of combustion find their outlet in pipe F, which extends upward into the sheet iron pipe M, connected with the hood L. The waste heat is thus utilized to accelerate the draft required to carry off the heavy fumes, and this is accomplished perfectly, even though the chimney has poor draft.

Fig. 3 is a gas forge. This forge is intended to replace the ordinary forges in machine shops, for forging and tempering tools. It consists of a round fire brick heating chamber having an inside diameter of 6 inches, with both ends closed by heavy fire brick slabs, 4 inches apart, firmly mounted between cast iron flanges, on a table 24x20 inches. The entrance to the heating chamber is through the mouth which is 3 inches wide by 2 inches high. A corresponding opening in the back, 3½x2½ inches, is ordinarily closed by a plug, but can be removed when a clear passage through the furnace is required, or to insert something which is too large for the front opening. Three burners project into the heating chamber from the distributing ring, so directed that direct contact of the flames with the work is avoided. Thus perfect combustion is steadily maintained, the work is quickly and evenly heated, and oxidation reduced to a minimum.

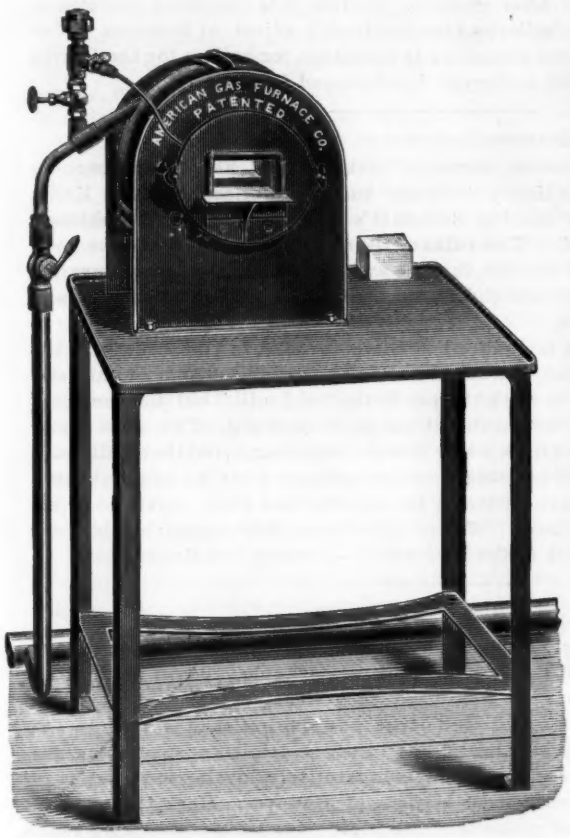


FIG. 3—GAS FORGE NO. 1.

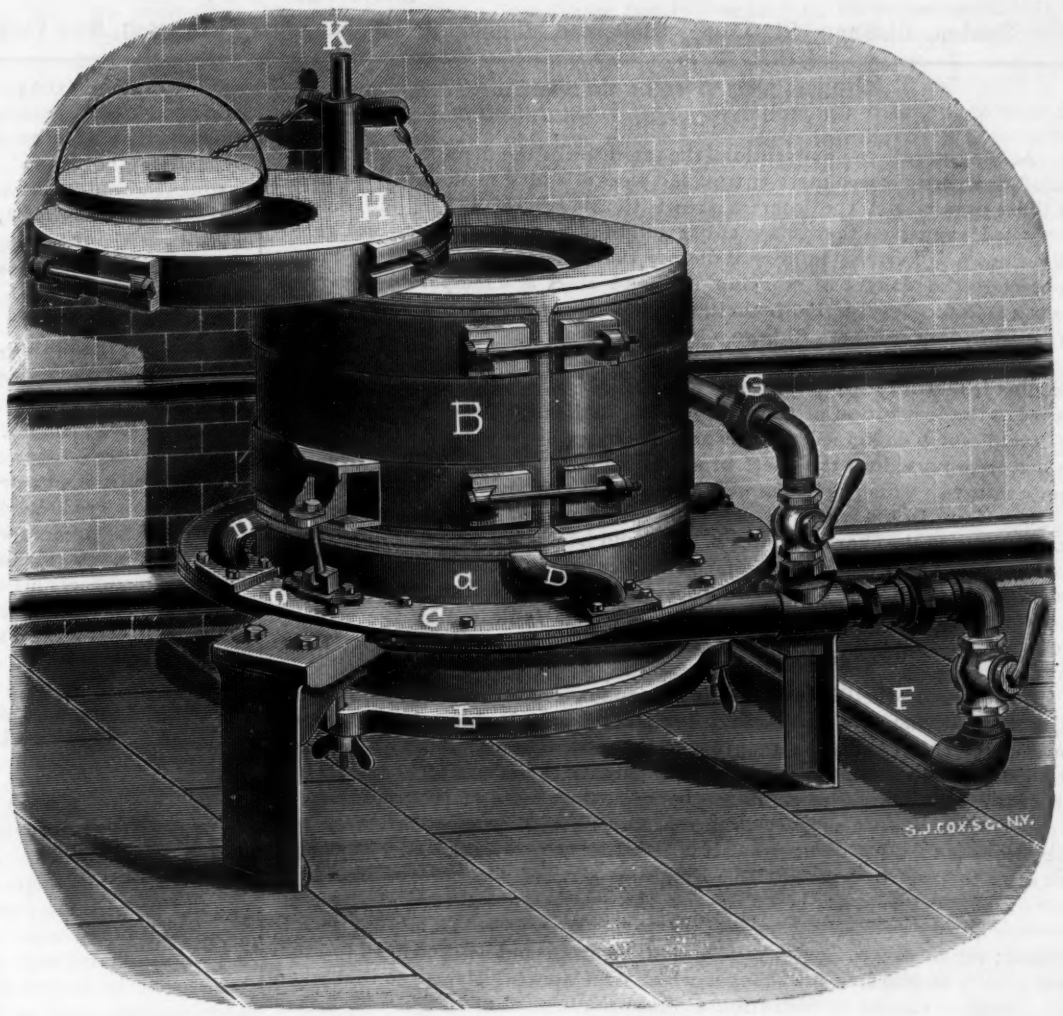


FIG. 4—MELTING FURNACE NO. 5 FOR BLACK LEAD CRUCIBLES NO. 20.

Fig. 4 is a melting furnace for black lead crucibles. The combustion chamber consists of the bottom A, and the cylinder B, both firmly secured to the distributing ring C. The burners D penetrate the "bottom" lining A, and are easily detached and replaced if necessary. The bottom is held in position by the iron platform L, which is easily dropped down to replace the lining. The cylinder B is secured to the distributing ring C by the hinged bolts O. The cover H is hinged to the shaft K, so as to lift clear of the furnace top, when swung to either side. The "feed hole" in cover H, is sufficiently large to give free access to the crucible without removing the cover, thus confining the heat while feeding the crucible. The small cover I closes the feed hole. The crucible stands upon a conical fire brick support, which is easily replaced. A channel through the bottom of the chamber A affords an outlet for the products of combustion, and in case of accident, the metal runs out of it into a drip pan. By means of outlets for the products of combustion, both at the bottom and top of the furnace, the greater heat can (in a measure) be made to act either upon the bottom or top of crucible. When the vent on top is tightly closed, the greatest heat will be below, while the partial opening of the cover I, will draw it upwards. Manufactured by the American Gas Furnace Co.; New York office No. 80, Nassau street, New York.

Buying Up the Hanging Rock Iron Properties

For several months, negotiations have been pending for the sale of several thousand acres of land in Lawrence, Jackson and Gallia counties, comprising Washington, Monroe, Gallia and Mt. Vernon furnace properties, and the Texas Hollow lands. Options were obtained on these vast properties, and about this time some of the options are expiring, though others have some days to run. But last Saturday a dispatch was received here from the agent of the purchasing syndicate saying that the propositions of sale would be accepted if the titles could be made all right. Of the latter there can be no doubt; and all that is now needed is the presence of the agent with the wherewithal to close the bargain. Nothing has been heard since the dispatch was received.

Who the purchasers are is not known here. It is hinted that they are persons having a great colonization scheme on hand. It is also hinted that it is a great railroad appendage of some kind. But the former surmise seems the most probable; and really, there would be plenty of wisdom back of such a project. There are good mineral and agricultural lands; houses already built for a large population; churches and school houses everywhere; roads and railroads. A community of several thousand could go there and sustain themselves from the start. They could herd and mine and till, and work at the furnaces; more of which of latest design being a part of the plan as we understand.

But the situation is no further advanced than we say, at the time of going to press. The contract is not closed and it may never be. The terms of purchase have been made; a telegram stating their acceptance has been received; in a few days, information more definite may be obtainable.—[Ironton (O.) Register, Aug. 6.

Iron Paper.

The (London) *Papermaker* says it will not, perhaps, be remembered that in the great Exhibition of 1851, a specimen of iron paper was exhibited. Immediately a lively competition ensued among ironmasters as to the thinness to which cold iron could be rolled. One ironmaker rolled sheets the average thickness of which was the eighteen-hundredth part of an inch. In other words, 1,800 sheets of this iron, piled one upon the other, would only measure one inch in thickness. The wonderful fineness of this work may be more readily understood when it is remembered that 1,200 sheets of thinnest tissue paper measures a fraction over an inch. These wonderful iron sheets were perfectly smooth and easy to write upon, notwithstanding the fact that they were porous when held up in a strong light.

An Iron Ore Discovery near Lebanon.

A Lebanon, Pa., special of August 1st, says: In making the excavation for the new supply reservoir for this city, three miles east of Cornwall, the workmen uncovered an 18-foot vein of iron ore. The entire ridge between the reservoir site and Cornwall is believed to be a mass of iron. Heretofore miners and scientists generally estimated the value of the Cornwall ore deposits by their great depth, but to this must now be added certainly three miles, if not more, in length, making altogether a deposit of iron ore the like of which for richness of assay and volume is unequaled in the known world. The land on which the new deposit was found is owned by William C. Freeman, who is also largely interested in the Cornwall mines. An assay of the ore shows that it contains from 65 to 70 per cent of iron.

PROTECTING YOUR BUILDING With an automatic fire sprinkler system makes it absolutely fire proof. All Insurance Companies recognize the "Neracher" as the best made and will make liberal reductions on your present rates if you equip. In this way the system pays for itself inside of two years' time.

☞ Write us.

THE NERACHER SPRINKLER CO., - WARREN, O.

BRANCH OFFICES:

Boston, Chicago, St. Louis, Cleveland, Cincinnati, Minneapolis, Pittsburgh, New York, Philadelphia, Baltimore, San Francisco.

BLUE SHORTNESS IN STEEL.

At the last railroad conventions the attention of the members present was called to a peculiar weakness of iron and steel at a blue heat, and the attitude of those present and the interest shown in the subject and in the samples exhibited, suggested that this peculiar action of some metals was not generally known. Further inquiry indicates that many metal workers do not appreciate the danger of working iron and steel at a temperature varying from 430 to 600 degrees Fahrenheit, which is the range during which a piece of polished iron or steel will have a blue color.

This is not a new discovery. It has been known in some of the older English iron works for more than 50 years. In 1886 Stromeyer presented a paper to the Institution of Civil Engineers, England, entitled "The Working of Steel," which contained a rather exhaustive review of the knowledge extant at that time regarding the effect produced on steel by working at different temperatures. This paper was well discussed at that time.

Mr. Howe, in his recent work: "The Metallurgy of Steel," devotes considerable space to the characteristics of steel and iron when at the temperature indicated by a blue color of a polished surface when cooling from a red heat, and when heated to the blue color from a normal temperature. This characteristic Mr. Howe termed "blue shortness." It is indicated by the steel or iron becoming brittle and losing its ductility and resilience. Mr. Howe says:

"The loss of ductility as measured by endurance of bending and drifting is enormous; that this is not due to incipient cracks is shown by the simultaneous increase of tensile strength, and by restoration of ductility by annealing. Heating to redness may completely remove the effects of blue working. There is such a general resemblance between the effects of cold and those of blue working, that we may suspect that the immediate effect of these two operations is identical in nature. It is true that the gain in elastic limit does not seem to excel that in tensile strength as markedly in case of blue as in case of cold working, nor is it clear that the tensile strength and elastic limit increase during rest after blue, as they do after cold working. But this is natural; for we saw reason to believe that heating cold-worked iron to blueness greatly accelerated the changes which cold working starts; so that when this change is started by distortion at blueness, instead of in the cold, it may occur so rapidly and so nearly reach its full growth before the metal grows cold that no considerable further change occurs thereafter. The effects of blue working are more intense and more injurious than those of cold working. . . . Out of sixteen comparable cases the previously worked blue pieces endure, in 18 less than 40 per cent., and in 11 less than 25 per cent. of the bending endured by the corresponding cold-worked piece."

Stromyer stated that the fracture at blueness is silky, although the steel acted as if it was what would be termed by blacksmiths "rotten." Blue-worked pieces, however, when cold show a crystalline fracture. Howe says that Valton found that his workmen had long recognized blue shortness and avoided hammering at blueness.

We are inclined to believe that American engineers do not as a rule understand that blue shortness is of sufficient importance to cause them to forbid, in their specifications, blue working of iron and steel; but is common to forbid working below a red heat, which probably covers the point. Blue working was rarely permitted for steel in the Forth Bridge. Probably American boilermakers appreciate better than any other class of mechanics the effect of working steel at this critical temperature. This is naturally so because they are more tempted to do this than other metal workers, owing to the time taken and required to fit up sheets closely in erecting boilers, and to decrease the expense of construction, which must be considerably augmented where sheets have to be repeatedly re-heated in order to keep them at a red heat during the time required in driving up flanges. The following from Mr. Howe's book, regarding the working of boiler sheets at a blue heat is pertinent.

"It is said that some boilermakers allow no blue working, stopping work when the metal becomes so cool that it no longer glows when rubbed with wood; others stop while the metal is still visibly red. Others insist that it is necessary to adjust some work, *e. g.*, marine boiler fronts, at blueness; that, despite the most careful hot working, adjustment is needed after the distortion due to cooling, especially as, owing to the endless variety of patterns, flanging in the press at a single heat is not practicable; that adjusting cold would lead to excessive waste of time, as iron is bent more quickly at blueness than when cold; hence these pieces are warmed locally to blueness by applying hot irons. To anneal afterward would be useless, as fresh adjustment would be needed after cooling. Certain it is that most Americans, and at least many foreign boilermakers, habitually adjust at blueness. Blue working without subsequent annealing is forbidden for boilers for the United States Navy, but not for the hull work."—[Railroad Gazette.

Bessemer's American Rival.

The origin of the Bessemer process of making steel has always been an honor divided between Sir Henry Bessemer and an American, William Kelly, who used the process now bearing Bessemer's name at a little old-fashioned furnace in Lyon county, Ky. The ruins of the old furnace still mark the spot, and it has been suggested that the furnace and the diminutive steel converter used by Kelly, shall be restored and placed among the exhibits at the Chicago show.—[Iron Trade Review.

The Kelly process was introduced at Olive furnace, in this county, at the same time, many years ago. It worked well. The product was brought here, and an attempt was made to work the pig in the "old mill," but the workmen said it was too hard. The fact is, that it was good steel pig. The same metal can be made there now at a little cost. It was always supposed that Kelly sold out to Bessemer, and so did not return to the process after he had first instituted it. It would have been better for the country had Kelly persisted in his discovery, on his own account. We are quite sure this region would have occupied a different relation to the iron world.—[Ironton (O) Register.

High Speed Triple Expansion Engines.

The extent to which triple and compound engines are now being employed in all modern steam engine plants is quite remarkable. When double and triple expansion engines were first used they were generally employed in connection with low piston speeds and large powers, but such is not now the case. One of the most recent installations in which triple expansion engines are employed for high speed work and comparatively low horse-power is in the case of the central electric light station, at Hanover. Here two engines have been installed, each of which is of the triple expansion condensing type, and each is expected to develop 300 horse-power at 115 revolutions. The cylinders are 16½, 27 and 41 inches in diameter, with a stroke of 19½ inches. The guaranteed steam consumption is only 13 pounds per indicated horse-power at a boiler pressure of 150 pounds, and condensers being employed. The engines are vertical, and are connected direct to the dynamos which they drive. These dynamos are of the Schuckert type and have armatures 10 feet in diameter, and commutators 6 feet 6 inches in diameter. The field contains 16 poles and the current is collected by eight sets of brushes.—[Railway Review.

Simple Iron and Steel Tests.

Simple tests for iron and steel are as follows: If a fracture of iron gives long silky fibres of a leaden hue, the fibres cohering and twisting together before breaking, it may be considered a tough soft iron. A medium even grain mixed with fibres is a good sign. A short blackish fibre indicates badly refined iron. A very fine grain denotes a hard steely iron, apt to be cold-short and hard to work with the file. Coarse grain with brilliant crystallized fracture and yellow or brown spots denotes a brittle iron cold-short, working easily when heated. This iron welds easily. Cracks on the edges of bars are a sign of hot-short iron. Good iron is readily heated soft under the hammer and throws out but few sparks. Nitric acid will produce a black spot on steel; the darker the spot the harder the steel. Iron remains bright if touched with nitric acid. Good steel in its soft state has a curved fracture and a uniform gray lustre; in its hard state a dull, silvery, uniform white. Cracks, threads or sparkling particles denote bad quality. Good steel will not bear a white heat without falling to pieces, and it will crumble under the hammer at a bright red heat, while at a middling heat it may be drawn out under the hammer to a fine point.

NICKEL PLATE Ninth Annual Niagara Falls Excursion runs August 17th. Enquire of Nickel Plate Agents.

STEAM USERS Should Read this.
Increase the Capacity of your Boilers.
Scale is a Non-conductor of Heat.

SAVE YOUR FUEL AND PROTECT YOUR BOILERS FROM SCALE AND GALVANIC ACTION OF WATERS. WATERS ANALYZED **FREE** AND THE COMPOUNDS MADE TO SUIT EACH WATER.

INTERNATIONAL BOILER SOLVENT.
(PURELY VEGETABLE.)

Dearborn Drug & Chemical Com'y,

Manufacturing and Analytical Chemists, W. H. EDGAR, Manager. Office, Room 29, Rialto Building; Works, 4246 Champlain Avenue;
Ohio Office, Canton, O. ROBERT H. CREVOISE, Agent.
WRITE FOR INFORMATION AND PRICES. BEWARE OF INFRINGEMENTS.
CHICAGO, ILL.

CANADIAN PIG IRON.

The production of domestic pig iron should be and no doubt is, an interesting subject for all who are interested in the development of our natural resources. At the time the Grand Trunk contracts were awarded there was some controversy as to the capabilities of our home furnaces for supplying pig iron, but if there are any doubts on the subject they are groundless. There are now already in operation in Canada three different establishments, two for the production of charcoal iron, and the third for the production of coke pig, and these will shortly be increased by another whose facilities for the production of coke are said to be unequaled. In the matter of charcoal iron, the leading establishment in point of production is that at Drummondville, Que. Its yearly output is in the vicinity of 4 500 tons. The other charcoal furnace, at Rodnor, is of smaller capacity, but its capabilities have been improved recently by the erection of a larger furnace which should increase its output to almost the same quantity as the above. The difficulty with these works, however, is the scarcity of fuel, but the quality of the iron produced at both is unsurpassed, for malleable iron work, car wheels, etc.

The coke works are of greater capacity, and they should be susceptible of still further development. The one at present in operation at Londonderry, N. S., has turned out in the vicinity of 25,000 tons per annum, or about half the importation of Scotch pig. It is anticipated, however, that the output will be largely increased this season. Previously the company endeavored to fill the position of a Jack-of-all trades; that is, they devoted their attention to bar iron, etc., as well as pig. They have now decided to reform this, have erected a much larger "stack" this season; will drop other lines, and devote their sole attention to pig iron, and therefore ought to produce a sufficient supply and not insufficient as heretofore. They now tap their furnaces four times a day, drawing 20 tons at each tap, or 80 tons a day. The new stock, however, it is claimed, increases their facilities by 50 per cent., so that their position is materially altered. As regards the quality of the iron it is fair on the whole, but the draft and ore vary considerably, which leads to irregularity.

In addition to these works enumerated above a furnace is in course of erection at New Glasgow, N. S., of equal extent, the location of which affords exceptional facilities. Briefly their ore, limestone and coal are all procurable at one place, and any one who knows anything about the production of iron will recognize the advantages in this. It will be seen, therefore, from the above facts that our pig iron industry is assuming respectable proportions for so young an infant.—[Hardware, Toronto.

CAST IRON BRICKS.

Most of the building materials now in use have been employed with greater or less skill for thousands of years. Since primitive man discovered the adaptability of stone, wood, and burned brick composed of clay and sand for house building, no equally useful building material has been added to the list. According to the *American Furniture Gazette*, a German mechanic has recently patented an invention which has certainly many advantages over the old-fashioned brick of clay, though the use may not prove it to be in all respects superior.

Its practical design and ingenuity are characteristic of the modern tendency of inventions. It is in the form and of about the size of the ordinary brick, but is composed of cast iron and is hollow.

The shell is so thin that the brick weighs less than the one made of clay. A wall is built of such bricks without the use of mortar, and no skilled labor is required in laying them. The upper and lower sides of the bricks are provided with grooves and projecting ribs, which fit into each other easily and perfectly, and form a wall of great strength.

There are also two long circular openings in the upper side of each brick, arranged so as to receive projections on the lower side of the brick that is to be placed above it. One of these projections is hook-shaped, which insures a solid hold. A wall of these bricks is very quickly put together.

After the wall is built it is covered with paint. This closes all the cracks, renders the wall air-tight and prevents the bricks from rusting. By the use of good paint the wall can be made highly ornamental. The bricks are very durable, and a building made of them is, perhaps, as nearly fire-proof as possible.

A wall thus constructed can be taken down or rebuilt as readily as it can be put up. There is no mortar to be removed, as there is when clay bricks are used. A house with such walls is cool in Summer and warm in Winter, for the large air spaces prevent the passage of heat.

With a supply of such bricks a man can put up his own house, and be entirely independent of brick-layers, mortar-mixers and hod-carriers. If he does not like his house, he can take it down and build another with the same material, which is always as good as new.

How Wide a Belt to Buy.

This is a question which calls for a good deal of explanation; so much depending upon what kind of a belt it is; upon how it is to be laced; upon how thick it is to be; upon how fast it is to be run; upon how much it is to wrap around the pulley, and other things, all of which influence the belt width needed.

But we will suppose that it is a leather belt $\frac{7}{32}$ inch thick, and that it is to be run upon a cast iron pulley in good condition, and that it is to wrap hal way round; then the width in inches required to transmit each horse-power will be, for single leather lacing, 10.839 divided by the belt speed in feet per second. If the lacing be single rawhide instead of single leather, each horse-power will require a breadth in inches, represented by 10.057 divided by the belt speed in feet per second; if the lacing is double leather, 9 381 divided by the belt speed in feet; double rawhide, 8.800 divided by the belt speed; and if the joints are riveted, 6.112 divided by the belt speed.

If the arc of contact is only 135° instead of 180°, then we have numbers to be divided by the speed in feet per second as follows:

Single leather lacing	12.669
Single rawhide	11.791
Double leather	10.990
Double rawhide	10.167
Rivets	7.168

Thus if we have 125 horse-power to be carrried by a $\frac{7}{32}$ inch belt upon a tcas iron pully, at a speed of 50 feet per second, it will require for single lacing and 180° arc of contact, $125 \times 10.839 \div 50 = 27.00$ ins.; and for double rawhide lacing, $125 \times 8.800 =$ only 22 inches. With 135° and single leather lacing, it will take $125 \times 12.699 \div 50 = 31.75$ inches; and with 135° and double rawhide, $125 \times 10.171 \div 50 = 25\,48$ inches.—[Power and Transmission.

Proposed Iron Works in China.

A remarkable statement of general interest was made on Monday on the Berlin iron market, and is now attracting considerable attention. The Chinese viceroy, Tschang-tchi-Tung is endeavoring to extend the use of railways in China, but his efforts meet with great opposition. With a view to overcome this, he proposes to first of all interest the population in his plans by providing the Chinese with remunerative employment by the construction of railways, the materisl for which would be produced in China. According to the scheme, work would first be commenced by the winning of iron ore and coal, then blast furnaces would be erected for the production of the crude iron, and finally rolling mills and engineering works would be established. In order to carry out this programme, it is said that several English and German technical men have already been engaged, and that the latter will at once commence exploiting the iron mines. In connection with these mines a railway 16 miles long, for the convenience of transporting the ore, etc., will be built, and the rails for which are those which were recently ordered from a German firm. A school of railway engineering has already been established, and is under the management of Herr Bauer, a German railway engineer. The young Chinese will there be instructed in the general construction and working of railways.—[Colliery Guardian (London), July 24.

The Elasticity of Nickel Steel.

Having regard to the superior excellence of nickel steel armor plates, which has recently been demonstrated, it may not be amiss to quote the remarks of a recognized French authority, M. Mercadier, bearing on the elastic properties possessed by nickel steel. This gentleman, who has spent many years in investigating the subject, is of the opinion that steel alloyed with nickel is destined to play a still greater role in the metallurgical world. By means of the acoustic method which he has invented, M. Mercadier finds that steel containing nickel in the proportion of 25 to 100 is perfectly homogeneous and almost completely isotropic. The incorporation of the nickel with the steel in sufficient quantity, he adds while increasing the homogeneity of the material, imparts to it an isotropy similar to that of the belles glaces of Saint Gobain. This result, interesting from a theoretical point of view, is also of importance in consideration of the practical industrial lessons that may be deduced therefrom.

A New Welding Process.

From Chicago comes the news of a new process of welding, which is performed by simple friction. The pieces of metal which are to be joined together are placed in a lathe and rapidly rotated. At the point of junction the ends are pressed into a die, thus giving the pieces the desired shape. The high temperature necessary to perform the welding, is, it is said, the result of the rapid movements of the pieces under pressure.

CENTRAL THOMSON-HOUSTON COMPANY,

48 ARCADE, CLEVELAND, O.

S. D. NESMITH, - - - - - - Manager.

Motors from 1-12 h. p. to 100 h. p.

ELECTRIC LIGHT PLANTS INSTALLED,

Arc and Incandescent, Direct and Alternating,

ELECTRIC FANS!
FANS FOR VENTILATING!
ELECTRIC SUPPLIES.

IT WILL PAY

you to investigate the merits of

THE HACKNEY POWER HAMMER,

Endorsed by leading Manufacturers throughout the Country.

Catalogues and all information cheerfully furnished by

THE HACKNEY HAMMER CO., Cleveland, Ohio.

INDUSTRIAL SUMMARY.

New Enterprises.—

A. F. Childs, W. H. H. Knight, F. F. Dean and others have incorporated the Knight Safety Elevator Co., at Washington, D. C.

The Hanover Machine Works have been organized with a capital stock of $100,000, at Frederick, Md., for the purpose of manufacturing machinery.

The Pottsville Insulated Wire Co., of Philadelphia have been chartered at Harrisburgh, Pa., to manufacture insulated wire and cables and electrical appliances.

A movement is said to be on foot at Dubuque, Ia., to organize a company to take the place of the Iowa Iron Works, when that concern moves to St. Louis, Mo.

Messrs. M. J. Frost, J. N. Hanson and A. Dyrenforth, of Chicago, have incorporated the Taylor Automatic Lubricator Co. The capital stock is placed at $3,000,000.

It is rumored that the Winona & Southern Railway Co. have purchased the Winona Harvester Works, at Winona, Minn., and will convert them into an extensive car manufactory.

A charter has been issued to the Birmingham Iron & Steel Co. with a capital of $50,000. Incorporators, W. H. Williams, J. Clark Williams, Charles Large and T. M. Thompson.

The Mackellar Foundry Facing & Supply Co., Quincy, are a new concern recently established for the purpose of supplying the Western market with the line of goods indicated by their name.

The Chicago Engine Packing Co. has been incorporated, with a capital stock of $50,000, by W. A. Lewis, E. D. Warren and E. D. Pence. The company will manufacture engine packing.

The Powell Wire Nail Machine Co., of Cleveland, was incorporated by Stevenson Burke, E. J. Ingersoll, E. T. Ives, D. A. Dangler, W. J. White, R. Powell and H. C. Emison; capital stock, $250,000.

The Hercules Foundry Co., incorporated in Massachusetts, with A. L. Rand, President, and O. B. Cole, Treasurer, has recently purchased and will complete the iron foundry of the Pike Manufacturing Co., to be located at Pell City, Ala.

A tract of 16 acres of land, at the junction of the Belt & Illinois Central Railways in Illinois, has been purchased by the National Maleable Iron Casting Co., for $40,000. On this property, as a site, it is proposed to erect a plant which will give employment to 600 men.

The Virginia Construction Co. has been granted a charter to engage in mechanical and engineering work. G. W. Goddary, of Roanoke, Va., is President, and Thomas Lancaster, of Norfolk, Va., Secretary. The capital stock is to be not less than $20,000 nor more than $50,000.

The syndicate that has bought the Whitely Reaper Works, in Springfield, O., will be known as the Central Car & Repair Manufacturing Co., and will have a capital of $500,000. The works will be started up within two months with a large force of hands, and will be the largest car works in the United States.

The Malden Water Motor Co. has been organized at Providence, R. I., under a Maine charter, with F. W. Sawyer, President; C. T. Small, of Malden, Mass., Treasurer, and John T. Vinal, of Providence, General Manager. The company proposes to purchase the G. M. Cruickshank engine works and to manufacture motors there.

A charter has been issued to the Birmingham Iron & Steel Co., of Pittsburgh, with a capital stock of $50,000. The incorporators are W. H. Williams, J. C. Williams, Chas. Large and T. M. Thompson. The new concern proposes to erect an open-hearth steel plant at Kensington, on the line of the Allegheney Valley Railroad, about 20 miles from Pittsburgh. Work on the plant will probably be commenced in a short time.

Additions, Enlargements, Removals, etc.:—

An addition will be built this Fall to the works of the Athol Machine Co., at Athol, Mass.

The Buda Manufacturing Co., Harvey, Ill., have commenced work on a new foundry building 80 x 120 feet in size.

J. & D. Noble will erect an iron foundry in connection with their boiler works, at Anniston, Ala.

The machine shops of G. H. Osbourn, at Clarksburg, W. Va., recently burned, will be rebuilt at once.

The Southern Engine & Boiler Works Co., Jackson, Tenn., will build a new boiler house 65 x 100 feet in size.

The Beech Manufacturing Co., of Hartford, Conn., have decided to abandon their works in that city, and to remove their entire plant to Beacon Falls, Conn.

The Piedmont Machine Works, of Piedmont, W. Va., states that it has established machine shop and foundry at Foundry Siding, W. Va., near Piedmont, and expects to have the place in operation about August 10th.

Additions are being made at the iron axle mill of Irondale, O., which it is stated, when completed, will be used for the manufacture of tinplate. The mill will be fitted up with the latest machinery for the manufacture of tinplate, and will give employment to about 75 more men.

General Industrial Notes:—

Cincinnati Architectural Iron Works, corner Front and Ludlow Sts., Cincinnati, O., have the contract for the iron work of the Penn Block, corner of 5th Ave. and Race St., in that city.

H. J. Reedy & Co., 128 East 8th St, Cincinnati, O., have the contract for two of their Climax high steam passenger elevators, for the six-story stone front building now being completed at 173 West 5th St., near Elm St.

Mary furnace, operated by the Ohio Iron & Steel Co., of Lowellville, O., made during the month of July 4,780 gross tons of pig iron, which is the largest product ever made in 31 days by that furnace. The iron is the company's well-known Ohio Scotch foundry iron and 92½ per cent. No. 1 broken and selected.

On the night of the 28th ult. the 12-hour turn in the converting department of the Edgar-Thomson Steel Works of Carnegie Bros. & Co., Limited, at Braddock, Pa., working from 6 P. M. to 6 A. M., made 62 heats, and turned out 938 tons of steel. This is believed to be the largest output ever produced under similar circumstances.

Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 26th day of August, 1891, for all the labor and materials required and fixing in place complete the low-pressure steam heating apparatus, etc., for the United States Marine Hospital, at Evansville, Ind.

Wm. M. F. Goss, Professor Experimental Engineering, Purdue University, LaFayette, Ind., writes as follows to the Stratton Separator Co., 32 Cortlandt Street, New York: "We have been using for about a year one of your 4″ separators in connection with the compound engine in our engineering laboratory. Steam for this engine is supplied by boilers located 580 feet away, and notwithstanding the long length of pipe through which it is thus required to pass, it was never found, by repeated calorimeter tests, to contain as much as three per cent. of moisture when it passes out of the separator, regardless of the amount of water previously held by the steam."

Some months ago the attention of the readers of this paper was called to the advertisement of the Cincinnati Iron Roofing & Corrugating Co., stating that they manufacture a metallic lath of considerable merit. This lath is made of sheet iron of sufficient width and length to handle easily, and is ribbed and grooved. In these grooves are round holes about one inch in diameter. These sheets are fastened against the wall and closely united, making a good foundation on which to put the plaster. The plaster fills the holes and grooves, and when fully hardened it becomes, it is claimed, more solid and stronger than ordinary lathing, and is a reliable protection against fire. This lathing is becoming quite well known and is being quite extensively used. It has been placed on the walls of the Carew Building, corner 5th and Vine Sts., Cincinnati, O., and it is to be used in the new City Hall building on Central Ave., of same city, and has been furnished for the Government building in Williamsport, Pa. Parties wishing further particulars can obtain same by addressing the company, Cincinnati, O., Room 91, Johnston Building.

The following is a partial list of the many contracts the Warner Elevator Manufacturing Co., 8th, Harriet and 7th Sts., Cincinnati, O., now have on hand for hydraulic elevators: Schloss & Kahn, Montgomery, Ala., one freight elevator; Headley Grocer Co., Springfield, Mo., one freight elevator; Empire Hotel Co., Dalton, Ga., one passenger elevator; Americus Hotel Co, Americus, Ga., one passenger elevator; Columbus Insane Asylum, Columbus, O., one freight elevator; E. W. Shaffer, Wheeling, W. Va., one freight elevator; John W. Farrell & Co., Danville, Va., one freight elevator; S. R. Turner, Marietta, O., one passenger elevator; W. T. & O. H. McWilliams, Rome, Ga., one passenger elevator; Dexter Horton, Seattle, Wash., two freight elevators; O. J. Wilsin, Cincinnati, O., one passenger elevator; William Miller, Cincinnati, O., one freight elevator; Thos. Emery's Sons, Cincinnati, O., two freight elevators; Steiner & Lobman, Montgomery, Ala., two freight elevators; Wood & Bond, Macon, Ga., one passenger elevator; Chattanooga Gas Light Co., Chattanooga, Tenn., one freight elevator; Lambert & Murphy, Bloomington, Ill., one passenger elevator; Miss Susie M. Faust, Birmingham, Ala., one freight elevator.

Roofers and builders have long felt the need of something to take the place of solder for repairing old roofs, gutters, etc., and especially iron and steel roofing when solder cannot be used. The Garry Iron & Steel Roofing Co., located at 152 to 168 Merwin St., Cleveland, are manufacturing a cement which they are using in connection with their goods and recommend very highly for this purpose. The successful use of this cement for some 15 years

THE LEFFEL WATER WHEEL & ENGINE CO.

Build a Splendid Line of

SELF-CONTAINED SIDE-CRANK **ENGINES**

—AND—

RETURN FLUE **BOILERS**

8, 12, 16 and 20 Horse Power.

High in Grade. Low in Price. Strictly First-class. In design and construction SUPERIOR to all others. Write for ENGINE PAMPHLET.

Address us in full as follows:

THE LEFFEL WATER WHEEL & ENGINE CO.

Greenmount Ave., SPRINGFIELD, OHIO, U.S.A.

KING OF THE ROAD MAKERS.

FORSTER'S PATENT

Rock Breaker.

For Macadam.

properly cubed. No gear wheels to break Product 10 to 200 tons per day according to size. Over 450 in use FOR COARSE OR FINE CRUSHING. Does the work of any other breaker with ⅓ the power and ⅓ the expense for keeping in repair.

Only manufacturers. Correspondence solicited.

TOTTEN & HOGG FOUNDRY CO., 23rd St. and Railroad Ave., Pittsburgh, Pa.

or more, gives the manufacturers in recommending it as the only cement or material in the market that can be used with success in repairing or laying iron, steel and tin roofing or gutters. Its composition is such that it remains in an elastic condition for years, and at the same time hardening on the surface sufficient to walk over it without injury. Owing to its elasticity, it accommodates itself to the expansion and contraction of the metal and does not crack or peel off. This cement is clear from acids, alkalis and tar substances, thus leaving the water coming in contact with it, perfectly pure. Old metal roofs and gutters repaired with this cement some ten years ago and which seemed comparatively worthless at the time, are good to-day. It is put up in iron cans containing 15, 25 and 50 pounds. This firm are also manufacturing and funnishing paints, both dry and mixed, ready for use. These paints are made from the purest Lake Superior iron ore of four colors—red, purple, brown and yellow. Owing to their heavy body, adhesiveness and elasticity, they are by far the best paints in the market for iron, steel, tin and wood painting The mixed paints are thoroughly mixed with the best linseed oil. These paints are also largely used for painting railroad cars, buildings and bridges of all descriptions. By using them in connection with their cement, roofs and gutters can be repaired without the use of any solder, making it much better and cheaper. Builders, hardware dealers, roofers and tinners will find it to their advantage to keep these goods in stock as they will find ready sale. Prices and sample colors mailed free upon application.

Bessemer Steel Made in Maryland

Last week (Saturday) the first Bessemer steel was made at the immense works of the Maryland Steel Co., at Steelton, Sparrow's Point, on the Patapsco river, a few miles below Baltimore. The construction of this enormous plant, including the furnaces which have been in blast some time, consumed four years.

As the operation began at 4 o'clock P. M., there was not time to do more than make a few Bessemer steel ingots, reserving to another day the tests of the blooming and the rail-rolling mills. As there was no intention to do more than make a test of the working of the ponderous machinery, much of which is of novel design, all was accomplished that had been expected.

When everything was ready the molten iron was carried to the converters (each one of which can, if necessary, blow thirty tons at one heat), the air blast was forced into their bottoms, and kept up until the entire charge was in a state of violent ebullition, after which a small quantity of speigeleisen or ferro-manganese was poured into the boiling mass, with which it was quickly amalgamated, and very soon thereafter the steel was ready for pouring into the ingot moulds. Every part worked smoothly, and the perfection of the plant up to that point was fully established. As the processes for transforming the ingots into blooms and then into finished rails are well understood, it can be taken for granted that the entire plant, with its many novel and economizing appliances, is complete, and that in due time this splendid enterprise will be in full operation, and turning out Bessemer steel at the rate of 2,000 tons daily.—[Manufacturers' Record.

Metallic Railway Sleepers.

The practicability of using steel railroad sleepers in the place of wooden ones is now being tested by the Philadelphia & Reading Railroad, two sections of track with steel ties and rails and stone ballast having been laid. The company put down a considerable portion of steel-tie track on its Bound Brook division several months ago. The experiment there is said to have been successful so far. The steel tie that is used was designed by Assistant Superintendent Bonzano. It is of the inverted trough type.

It is claimed that not only iron, but copper and brass, can be welded equally well, while the operations require but a few seconds of time.

CHAUTAUQUA Excursion free, Toronto Excursion $1.00 extra, Lewiston Excursion 25 cents extra. These side trips are arranged for the Nickel Plate

THE STIRLING COMPANY

MANUFACTURE

The Safest, Most Economical, Compact and Durable High Pressure

WATER TUBE BOILERS.

All Wrought Steel. Large Mud Drum. Perfect Circulation.

By removing four manhole covers access is gained to every part of the boiler. Dry steam and great economy of fuel guaranteed.

GENERAL OFFICE: Pullman Bl'g., Chicago. PITTSBURGH OFFICE: Lewis Block. NEW YORK OFFICE: 74 Cortlandt St.

Works: BARBERTON, SUMMIT COUNTY, OHIO.

Ninth Annual Niagara Falls Excursion of August 17th. Enquire of Nickel Plate Agents.

The Fatigue of Metals.

With respect to statements that occasionally appear on the subject of the fatigue of metals under long continued stress, a report that has recently been published regarding two similar suspension bridge links is worthy of notice. A square iron link 12 inches wide, 1 inch thick and about 12 feet long, says The *Electrician* (London), was taken from a bridge at Kieff, then about 40 years old, and tested against a similar link which had lain unused in store ever since the building of the bridge. The means of comparison were, therefore, excellent, and the result should go a long way to show whether or not iron really does lose any of its strength in prolonged service. The effect of the tests was to determine for the old used link an ultimate tensile strength of 21 8 tons per square inch, an elastic limit of 11.1 tons per square inch, an elongation of 14.05 per cent. and a contraction of 17.35 per cent. at the point of fracture. For the unused link the tensile strength was found to be 22.2 tons per square inch, with an elastic limit of 11.9 tons, an elongation and contraction at fracture of 18 42 per cent. and 18.75 per cent. respectively. The two pieces of iron were, therefore, of practically identical strength; for the small difference actually observed is well within the ordinary range of variability of similar pieces of the same metal.

TEXAS has decided to set apart a spacious room in its building at the Columbian Exposition for an exhibit by the colored people of the State.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

A S. FERRY, Gen'l Agt., 208 Superior Street, Cleveland, O.
C. A. BURWELL, Chief Inspector, 208 Superior St., Cleveland, O.
R. D. BRIGGS, Special Agt., 208 Superior St., Cleveland, O.
J. E. WOLCOTT Special Agent, 208 Superior St., Cleveland, O.
L. C. BURWELL, Special Agent, 81 4th Ave Pittsburgh, Pa.

S. T. W. Ejector.

For Raising Water from Deep Wells, Streams, Excavations, &c.

The cheapest made. Send for prices

JAMES JENKS,
Manufacturer,
DETROIT, MICH.
M. P. SATTERTHWAITE, Agt., Cleveland, O.

FOR
ARTISTIC
PRINTING
WRITE
CLEVELAND
PRINTING &
PUBLISHING CO.,
CLEVELAND, O.

BOSTWICK PATENT.

A great saving in mortar, material and labor Write for Cata ogue and Sample.
THE BOSTWICK STEEL LATH CO.,
38 Park Row. New York City Niles, O
Mention this Paper.

L. M. OLDFIELD.

Merchandise Broker.

Correspondence Solicited.

WICHITA, KANSAS.

SHEPARD'S NEW $60

SCREW CUTTING

Foot Lathe

Cap Lathes, $1.25

Foot & Power Lathes, Drill Presses, Scroll-Saw Attachm'ts, Mandrels, Chucks, Twist Drills, Dogs, Calipers, etc. Lathes on trial Lathes on payment.

Send for catalogue of Outfits for Amateurs or Artisans. Address H L. SHEPARD, Agt., 124 East Second St., Cincinnati, O.

GRANULATED RAW BONE

For Case-hardening and Coloring.

For samples, prices, etc., apply to

THE ROGERS & HUBBARD CO., Middletown, Ct.

PATENTS

For INVENTORS. 40-page BOOK FREE. Address W.T. Fitzgerald, Att'y at Law, Washington, D.C

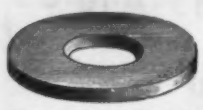


Plate Iron Washers
A SPECIALTY!
Even in Gauge, smooth and well finished.

Cut from new plate, rolled expressly for the purpose. ☞Write for prices, Address,
MILTON MFG CO.. Milton, Pa.

SAMPLES & PRICES & APPLICATION

ALUMINOUS METAL ROOFING.

EAVE TROUGHS
CONDUCTOR PIPES.
VALLEYS.
SHINGLES &
SUPERIOR TO COPPER AT PRICE OF TIN.
NON-CORROSIVE. REQUIRES No PAINT FOR PROTECTION.
SOLE MFGRS.
STAN-ALUMIN METAL CO. CANTON-O

EDISON GENERAL ELECTRIC COMPANY,

EDISON BUILDING, BROAD ST., NEW YORK.

Electric Lighting.	Electric Motors.	Electric Railways.	Electric Drills.
INCANDESCENT AND ARC. SAFEST AND BEST LIGHT IN USE.	FOR ALL POWER PURPOSES SAFE AND RELIABLE.	PASSENGER, TRAMWAYS, MINE HAULAGE.	PERCUSSION AND DIAMOND, FOR MINING.

Address Nearest District Office.

DISTRICT OFFICES:

CANADIAN DISTRICT, Bank of Commerce Building, Toronto, Ont.
CENTRAL DISTRICT, 173-175 Adams St., Chicago, Ill.
EASTERN DISTRICT, Edison Bldg., Broad St, New York.
NEW ENGLAND DISTRICT, 25 Otis St., Boston, Mass.
PACIFIC COAST DISTRICT, Edison Bldg, 112 Bush St, San Francisco, Cal.
PACIFIC NORTHWEST DISTRICT, Fleischner Bldg., Portland, Ore.
ROCKY MOUNTAIN DISTRICT, Masonic Bldg., Denver Col.
SOUTHERN DISTRICT, Gould Bldg, 10 Decatur St., Atlanta, Ga.

IRON CLAD PAINT CO.

Factory, 76 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.
CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE
Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and cheapest Paint made.

FURNISHED both Dry and Ground in Oil.

USED BY NEARLY ALL THE RAILROADS

DIXON'S GRAPHITE PAINT

THOSE who use it say that one pound will cover 2 to 3 times more surface and last 4 to 5 times longer than any lead, mineral or metallic paint. A tin or iron roof well painted will not require repainting for 10 to 15 years

JOS. DIXON CRUCIBLE CO.,
Jersey City, N. J.

CLEVELAND
GALVANIZING WORKS.

H. H. HODELL & CO.,

Galvanizing in all its branches, and Manufacturers of Rubber Buckets for chain pumps.
CLEVELAND, OHIO.

FOR SALE.

1 $250 BOND - First-Class Security.

Bearing 8 per cent., payable semi-annually.

WANT TO REALIZE AT ONCE. ADDRESS,

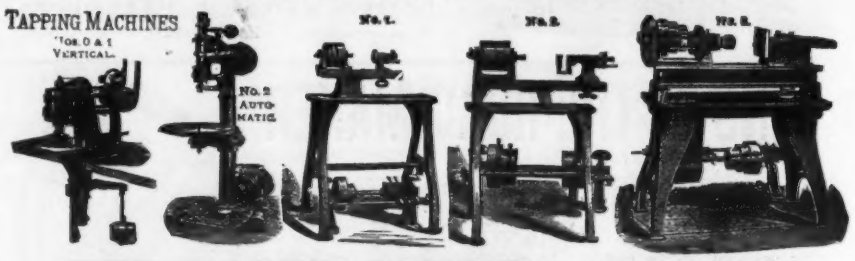
W. N. C.,

Room 1, 29 Euclid Ave., CLEVELAND, O.

FOR SALE---BLOWING ENGINE.

Vertical pattern, with balanced steam slide valve gear, steam cylinder 14-in. diameter, air cylinder 40 in. diameter, stroke 24 in., 1 to 190 strokes per minute; engine new. For price and particulars address **THE JAMES LEFFEL & CO., Springfield, O.**

OUR LINE OF TAPPING MACHINES.



THE GARVIN MACHINE COMPANY,

Manufacturers of, and Dealers in, all kinds of

MACHINERY AND MACHINE TOOLS.

Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Profilers, Chucking Machines,

Gear Cutters, Die and Cutter Grinders, Tapping Machines, Wire-Spring Coilers, Milling Cutters, &c.

Plants for Manufacturers of Sewing Machines & Electrical Goods.

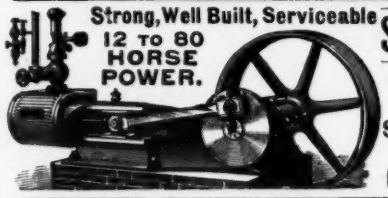
GEAR-CUTTING AND MILLING IN ALL ITS BRANCHES.

Laight & Canal Sts. [Catalogue sent on Application.] **NEW YORK.**

PORTBLE, HAND OR BELT **PIPE**

CUTTING & THREADING MACHINE.

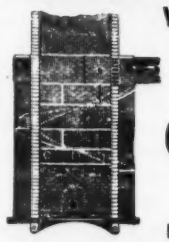
Double Application of Power. Double Leader Screw
Instantly Changeable, range from 1 to 6 in. Pipe.
Write for Description and Prices
WELLS MACHINE WORKS, FOSTORIA, O.



Strong, Well Built, Serviceable
12 TO 80 HORSE POWER.

STEAM ENGINES

ADAPTED TO HEAVY, CONTINUOUS WORK.
EVERY ENGINE TESTED UNDER FULL LOAD.
Suitable **BOILERS** on hand for immediate delivery
FOR DESCRIPTIVE CIRCULARS ADDRESS
CHANDLER & TAYLOR CO., INDIANAPOLIS, IND.



VICTOR COLLIAU,
Sole Manufacturer of the
Improved Patent
HOT BLAST
COLLIAU CUPOLA
ADDRESS:
287 Jefferson Ave.,
DETROIT - MICH.

Bischoff Metal Ceilings,

(PATENTED.)

It will pay to investigate and write for catalogue.

Estimates submitted on application.

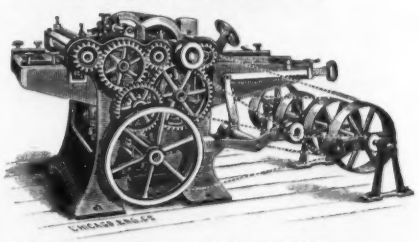
Fred. F. Bischoff & Co.
24 W. Lake St,
CHICAGO, - ILL.

TRADE MARK.

The Dunnning Boiler.
OLDEST AND BEST FOR
STEAM and HOT WATER HEATING.
Over 16,000 in use. Also Steam Engines and Boilers of all kinds and Machinery generally. Manufactured at the
N. Y. CENTRAL IRON WORKS.
80 EXCHANGE ST.,
GENEVA, N. Y.

Wood - Working Machinery

OF EVERY DESCRIPTION.



No. 2 Clipper Planer, Matcher and Moulder.

When in want of an A 1 Planer and Matcher, Surfacer, Hand Planer, Shaper, Moulder, Mortiser, Tenoner, Band Saw, Scroll Saw, Gang Edger, Rip Saw, Cross-Cut or Swing Saw, in fact any Wood-Working Machinery, write for our special prices and catalogue.

INDIANA MACHINE WORKS,
FORT WAYNE.
IND.

INDUSTRY FILE WORKS,
A. & H. Gough, Props.,
Manufacturers of
Files and Rasps,
Equal to the Best English File.
OLD FILES RE-CUT.
All Kinds of Job Grinding.
OFFICE & WORKS,
48 COLUMBUS ST.,
CLEVELAND, O
C. GOUGH Manager.
Mention this paper.

PERFORATED METALS OF EVERY DESCRIPTION BY THE HARRINGTON & KING PERFORATING CO. CHICAGO.
284 Pearl St., cor. Beekman. NEW YORK.

IRON AND STEEL MARKETS.

PIG IRON.

CLEVELAND (f. o. b. cars, net cash) Bessemer, $17 30; No. 1 Foundry, $16 80; No. 2 Foundry, $15 80; No. 1 Gray Forge, red short, $14 80; No. 2 Gray Forge, neutral, $14 30; No. 1 American Scotch, $16 80; No. 2 American Scotch, $15 80.

CHICAGO (reported by Messrs. Rogers, Brown & Merwin): Southern Coke No. 1 foundry, $16 25@17 00; Southern Coke No. 2 Foundry, $15 25@16 00; Southern Coke No. 3 Foundry, $14 75@15 50; Southern Coke No 1, Softeners, $15 25@16 00; Southern Coke No. 2, Softeners, $14 50@15 25; Ohio Silveries No. 1, $17 50@18 50; Ohio Silveries No. 2, $16 50@17 50; Ohio Strong Softeners No. 1, $18 00@19 00; Ohio Strong Softeners No. 2, $17 25@18 25; Lake Superior Charcoal Nos. 1 to 6, $17 75@18 50; Tennessee Charcoal No. 1, $18 00@19 00; Tennessee Charcoal No. 2, $17 00@18 00; Southern Standard Car Wheel, $21 00@23 00; Tennessee Standard Car Wheel, $00 00@00 00.

CINCINNATI (reported by Rogers, Brown & Co.): FOUNDRY IRONS—Southern Coke, No. 1 foundry, $15 00@15 25; Southern coke, No. 2 and No. 1 soft, $13 75@14 00; Hanging Rock coke, No. 1 foundry, $16 50@17 50; Jackson Co. Stone Coal, No. 1 foundry, $16 50@17 00; Tennessee Charcoal, No. 1 foundry, $16 50@17 50; Hanging Rock Charcoal, No. 1 foundry, $20 00@22 00. MILL IRONS—Standard Southern Coke, grey forge, $12 75@13 00; Standard Southern Coke, mottled, $12 25@12 50; Cold Short Southern Coke, grey forge, $12 75@13 00; Strong Ohio Neutral Coke, grey forge, $15 00@15 50. CAR WHEEL AND MALLEABLE—Standard Alabama Car Wheel, $19 50@20 50; Tennessee Car Wheel, $18 00@19 00; Lake Superior Car Wheel, $19 00@20 50.

BUFFALO (reported by Rogers, Brown & Co.): Mahoning and Shenango Valley strong, No. 1 Foundry, $16 50@00 00; Mahoning and Shenango Valley strong, No. 2 Foundry, $15 50@00 00; Ohio Softener No. 1, $16 50@00 00; Ohio Softener No. 2, $15 50@00 00; Jackson Co., Silvery No. 1, $17 80@00 00; Jackson Co. Silvery, No. 2, $16 80@00 00; Lake Superior Charcoal, $18 00@00 00; Tennessee Charcoal, $17 50@19 00; Southern Softener No. 1, $15 75@16 00; Southern Softener No. 2, $15 00@15 25; Southern Strong No. 1 Foundry, $16 50@16 75; Southern Strong No. 2 Foundry, $15 75@16 00; Alabama Car Wheel, $22 00@22 50; Hanging Rock Charcoal, $23 00@24 00.

LOUISVILLE (reported by Hall Bros. & Co.) HOT BLAST FOUNDRY—Southern coke No. 1 $14 25@14 50; Southern coke No. 2, $13 50@14 00; Southern coke No. 3, $13 00@13 25; Mahoning Valley (Lake ore mixtures), $00 00@00 00; Southern charcoal, No. 1, $16 00@17 00; Southern charcoal, No. 2, $15 50@16 00; Missouri charcoal, No. 1, $17 00@17 50; Missouri charcoal, No. 2, $16 50@17 00. FORGE—Neutral coke, $12 50@12 75; Cold short, $12 25@12 50; Mottled, $11 75@12 00 CAR WHEEL AND MALLEABLE—Southern (standard brands), $19 00@19 50; Southern (other brands), $17 00@18 00; Lake Superior, $20 00@21 00.

ST. LOUIS (reported by Rogers, Brown & Meacham): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $15 50@15 75; Southern Coke No. 2, $14 50@14 75; Southern Coke No. 3, $13 75@14 00; Southern Grey Forge, $13 25@13 50; Southern Charcoal No. 1, $17 25@17 75; Southern Charcoal No. 2, $16 75@17 25; Missouri Charcoal No. 1, $15 50@16 00; Missouri Charcoal No. 2, $15 00@15 50; Ohio Softeners, $18 00@19 00. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $19 50@20 00; Southern, $19 50@20 00. CONNELLSVILLE COKE—East St. Louis, $0 00; St. Louis, $5 65.

DETROIT (reported by William F. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $18 00@18 50; Lake Superior (coke) Bessemer, $17 75@18 25; Katahdin (Maine charcoal), $00 00@00 00; Lake Superior Coke, Foundry, all ore, $17 50@18 00; Lake Superior Coke, Foundry, all ore, $00 00@00 00; Standard Ohio Black Band, $18 00@18 25; Southern No. 1 $16 25@16 50; Southern Gray Forge, $14 00@14 50; Jackson County (Ohio) Silvery, $18 00@18 50; Old Car Wheel, $00 00@00 00. Connellsville Coke, $0.00.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry $14 50@15 00; Southern Coke No. 2 Foundry $13 75@14 25; Southern Coke No. 3 Foundry $13 25@13 75; Grey Forge, $12 75@13 25; Southern Coke Silver Grey, $00 00@00 00; Southern Charcoal No. 1 Foundry, $16 00@17 00; Car Wheel, $19 00@20 00.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $16 25@16 50; No. 2 Foundry, $15 25@15 50; Grey Forge, $14 25@14 50; White and Mottled, $13 25@13 50; Warm Blast Charcoal, $18 00@20 00; Cold Blast Charcoal, $22 00@27 00; Bessemer, $16 00@16 25.

MERCHANT IRON AND STEEL.

Flat Bar

1½ to 4 by ⅛ to 1 inch	1 80
4½ to 6 by ⅛ to 1 inch	1 90
1½ to 6 by 1¼ to 2 inch	2 20
1¼ & 1½ by ⅛ to ¼ inch	1 90
1 & 1¼ by ⅛ to ¼ inch	2 00
⅛, ¼ and ⅜ by ⅛ to ½ inch	2 20

Round and Square.

1 to 1⅜ inch	1 80
2 to 2½ inch	2 00
2¾ to 3¼ inch	2 30
3½ to 4 inch	2 80
4¼ to 4½ inch	3 30
4¾ to 5 inch	3 50

Oval.

¼ to 1¼ inch	2 20
⅜ to ¾ inch	2 40
⅞	2 60
½	3 00

Half Oval and Half Round.

1¼ to 3 inch	2 90
⅜ to 1¼ inch	2 50
⅜ to ¾ inch	3 10
½	3 30
⅝	4 80

Heavy Band.

¼ to 6 by ¼ and 5-16 inch	2 00
¼ to 1¼ by ¼ and 5-16 inch	2 10
⅜ to ⅞ by ¼ and 5-16 inch	2 30
½ to ⅝ by ½ and 5-16 inch	3 80

Hoops.

1¼ to 4, Nos. 13 to 15	3 60
1¼ to 2, Nos. 16 to 18	2 70
1¼ to 2, No. 19	2 80
1¼ to 2, No. 20	2 90
1¼ to 2, No. 21	3 00
1¼ to 2, No. 22	3 10
15-16, I and 1¼, Nos. 13 to 15	2 80
15-16, I and 1¼, Nos. 16 to 18	2 90
15-16, I and 1¼, Nos. 19 and 20	3 00
15-16, I and 1¼, No. 21	3 10
15-16, I and 1⅜, No. 22	3 20
⅞, Nos. 13 to 15	3 00
⅞, Nos. 16 to 18	3 10
⅞, Nos. 19 and 20	3 20
⅞, No. 21	3 30
⅞, No. 22	3 40
13-16, Nos. 13 to 15	3 20
13-16, Nos. 16 to 18	3 30
13-16, Nos. 19 and 20	3 40
13-16, No. 21	3 50
13-16, No. 22	3 60
¾, Nos. 13 to 15	3 30
¾, Nos. 16 to 18	3 50
¾, Nos. 19 and 20	3 60
¾, No. 21	3 70
¾, No. 22	3 80
11-16, Nos. 13 to 15	3 50
11-16, Nos. 16 to 18	3 70
11-16, Nos. 19 and 20	3 80
11-16, No. 21	3 90
11-16, No. 22	4 00
⅝, Nos. 13 to 15	3 80
⅝, Nos. 16 to 18	4 00
⅝, Nos. 19 and 20	4 10
⅝, No. 21	4 20
⅝, No. 22	4 30
⅝, No. 23	4 50

Light Band.

1¼ to 6 by ⅛ to 3-16 in	2 20
1¼ to 6 by Nos. 11 and 12	2 30
1 to 1¾ by ⅛ to 3-16 in	2 40
1 to 1¾ by Nos. 11 and 12	2 50
⅞ and 13-16 by ⅛ to 3-16 in	2 70
⅞ and 13-16 by Nos. 11 and 12	2 80
¾ and 11-16 by ⅛ to 3-16 in	3 00
¾ and 11-16 by Nos. 11 and 12	3 10
⅝ and 9-16 by ⅛ to 3-16 in.	3 30
⅝ and 9-16 by Nos. 11 and 12	3 40
½ by ⅛ to 3-16 in	3 60
½ by Nos. 11 and 12	3 70

Wagon Box Iron.

⅜ inch, beveled edge, by Nos. 11 and 12	2 80
⅜ inch, " " " 13 and 14	3 00
½ inch, " " " 11 and 12	3 10
½ inch, " " " 13 and 14	3 30

Sheet Iron.

No. 10 to 14	2 65
No. 15 to 17	2 75
No. 18 to 21	2 99
No. 22 to 24	3 15
No. 25 to 26	3 30
No. 27	3 40
No. 28	3 50

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 60
C No. 1, " "	2 85
C H No. 1 " "	3 10
C H Flange, " "	3 85
Extra Flange, "	4 35
Solid Fire Box "	5 10

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 75
Shell	3 15
Flange	3 45
Marine Flange	3 85
Fire Box	4 55

Above includes plates 90 inches wide.

90 to 96 in. wide	½c lb extra
96 to 100 in. wide	1c "
100 to 104 in. wide	1½c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs
1 to 2 in. inclusive	09
9-16 to ⅞ in "	09
7-16 to ⅝ and 2⅜ to 3 in	10½
3⅛ to 4 in	11
⅝ to 11-16 and 4⅛	10½
⅛ to 6 in	11½
¼ to 9-32 and 6⅜ to 7 in	12
3-6 in	14

Flats.

	cts. lbs
2 to 9-16 wide by 2 to ⅛ thick	9

Bessemer and O. H. Steel.

Machinery, base price,	2 75
Tire, "	2 75
Spring, "	3 25
Sleigh Shoe "	2 75
Toe Calk "	3 00
Cutter Shoes, tapered and burr. "	3 00

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	36c

Burden Boiler Rivets.

⅜, ½, 11-16 and ¾ inches diameter	4 00
Bridge ⅜, ½, 11-16 and ¾ inch diam	4 00

SCRAP IRON AND OLD METAL.

NET TONS	
No. 1 R. R. wrought scrap	$18 00
No. 1 wrought scrap	16 50
No. 1 Machine cast scrap	11 50
Iron axles	23 50
Axle turnings	13 50
Wrought turning (free from cast)	11 50
Cast borings	8 00
Uncut wrought iron boilers	11 50
Steel boiler plates	16 00
Grate Bars	8 00
Pipes and flues (Clean)	12 00
Tank iron	12 50
Hoop and band iron	9 50
Sheet iron	8 50
Wrought drillings	11 00
Malleable iron	9 50

Reported by Messrs. BLACK & POLLOCK, Cincinnati, O.:

Railroad Wrought	$20 00
No. 1 Country Wrought	17 00
Stove Plate	8 75
Machine Castings	11 00
Hoop and Sheet	8 00
Casting Borings	9 00
Wrought Turnings	12 00

THE CAMBRIDGE IRON & STEEL CO.
MANUFACTURERS OF
SHEET IRON AND SHEET STEEL
CAMBRIDGE REFINED IRON. TRADE MARK
Squared Roofing Sheets a Specialty
CAPACITY RANGES FROM No. 30 26 INCHES WIDE TO 1-4 x 40-120
CAMBRIDGE SOFT STEEL. TRADE MARK
CORRESPONDENCE SOLICITED
OFFICE AND WORKS CAMBRIDGE, OHIO.

CLEVELAND ROLLING MILL CO.,
MANUFACTURERS OF
BESSEMER STEEL RAILS,
Blooms and Billets, Steel Angles, Forgings, Bar and Spring Steel, Steel Street Rails, Steel Oil Barrel Hoops, Wire of all Kinds, Iron and Steel Boiler Plates, Galvanized and Black Sheet Iron, Corrugated Iron Roofing, Sheet Steel.

CATALOGUES Printed in the Highest Style of Art, by The Cleveland Printing & Publishing Co., Cleveland, O.

DALLIBA, CORRIGAN & CO.,
DEALERS IN
Iron Ore & Pig Iron,
Rooms 716, 717, 718, 719 Perry-Payne Bld'g.
CLEVELAND, O.

OGLEBAY, NORTON & CO.,
Successors to Tuttle, Oglebay & Co.,
Commission Dealers in
Iron - Ores,
FROM MARQUETTE, GOGEBIC AND MENOMINEE DISTRICTS,
CLEVELAND, OHIO.

J. H. OUTHWAITE. W. G. POLLOCK.
J. H. OUTHWAITE & CO.,
Exclusive attention given to
LAKE SUPERIOR AND MENOMINEE RANGE
Iron Ore,
Perry-Payne B'ld'g. Cleveland, O.

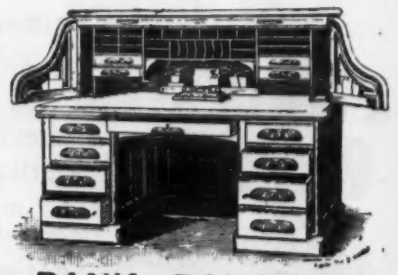
THE CONDIT-FULLER CO.,
Pig and Bar Iron,
CLEVELAND, OHIO.

E. C. POPE,
COMMISSION DEALER IN
Iron Ore, Pig Iron
AND METALS.
Cleveland, - Ohio.

Sam'l. L. Matner, Prest. & Treas. Fred. A. Morse, Sec'y.
Cleveland Iron Mining Co.,
Dealers in Iron Ores
from their own mines near Marquette, Lake Superior.
Rooms 4 & 5 Mercantile Bank Building,
CLEVELAND O.

PITTSBURGH & WHEELING COAL CO.,
MINERS AND SHIPPERS OF
Ohio Steam Coal and Coke.
Mines on the Cleveland, Lorain & Wheeling R. R. Capacity, 3,000 tons daily.
Office, 6 Mercantile Bank Building,
CLEVELAND, OHIO.
Lake Shipping Point, Lorain O.
JAS. PATTERSON, Sales Agent.

ESTABLISHED 1854.
PETER GERLACH & CO.,
MAKERS OF
Saws, Tools and Machinery.
Office and Warerooms, 28 Columbus st. Factories on Columbus, Winter and Leonard streets.
Cleveland, O., U. S. A.

DESKS.

BANK, RAILROAD
—AND—
OFFICE + FURNITURE.
Interior Work a Specialty.
Send for Illustrated Catalogue.
THE CLEVELAND DESK CO.
97-99 Ontario St., - - Cleveland, Ohio.

MACHINERY SUPPLY MARKET.

Anvils.

American.....₩ lb 9@10
Wrights.....₩ lb 12

Bellows.

Blacksmiths' { Hill's.....dis 40 / Bullock's.... dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70
" " " extra.....dis 60&5
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard..dis 60&10
Shults Raw Hide Leather Belting, single.....dis 40
Shults Raw Hide Leather Belting, double, and Light Double.....dis 40
Standard, oak tanned.....dis 50&10
Alexander Brothers' pure oak tanned. ...dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 25

Borax.

.....₩ lb 12

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 33⅓
" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
Whiton's Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Almond Drill.....dis 20
Morse " .....dis 15
Skinner's Combination Lathe.....dis 33⅓
" Independent Lathe.....dis 40
" Universal Lathe.....dis 40
" Drill.....dis 15

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3½

Drill and Drill Sockets.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1⅝".....dis 50&10
Morse Taper and Straight shank Larger than 1⅝".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2½c
¼ kegs ₩ lb	4½c	5½c		2¾c
⅛ kegs ₩ lb	4½c	5½c		3 c
10 lb cans, 10 in case	6 c	6½c		5 c
10 lb cans, less than 1	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 45@50
H. H. Barton.....dis 50@50&10

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 50
Reynolds Bros.' Hand Cut.....dis 50
ndustry File Works, hand cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	⅜	5-16	½	⅝	¾	⅞	1
Square	8	7	5⅝	4½	4	2¾	3¼
Hexagon	15¾	11¾	8¾	6	3½	3¾	5
Washers	9	8	7	5	4½	4¾	4¾

In lots less than 100 lbs, ₩ lb add ¼c., lb boxes add 1c to list.

Nails (wire.

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate { Car lots.....$2.30 / Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17,.....dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ¾ inch and over.....₩ lb 15¾
Sisal, ¾ inch and over.....₩ lb 13½

Sand Paper.

B. A. & Co.....dis 45@50
H. H. Barton's.....dis 40@45
New England Flint.....dis 40@50
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 40@10
" Band.....dis 20
" Scroll.....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 30
Atkins' Circular Saws.....dis 40&45
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 33c "
No. 1 Handles.....dis 23c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay.....dis 45

Screws.

Wood Screws—New List 1890.

Flat head iron.....dis 72½
Round head iron.....dis 67½
Flat head brass.....dis 72½
Round head brass.....dis 65
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 65
Machine, round head, iron.....dis 60
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ⅜ lb Balls	21c@29c	
No. 18 " " ¼ and ½ "	18c@28c	
No. 36 " " ¼ and ½ "	16c@27c	
2-Ply Hemp, ¼ & ⅜ lb Balls (Spring Twine	11½c	
3-Ply " 1 lb Balls	12@12½c	
4-Ply " 1½ lb Balls	11@11½c	
Cotton Wrapping, 5 Balls to lb	15@16c	

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 35

Wire.

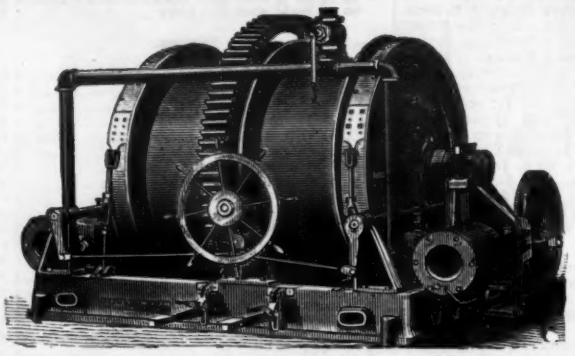
New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26..dis 75@75&5
" " Nos. 27@36..dis 75&10&5
Coppered Nos. 0 to 18, market list..dis 70@70&5
Galvanized Nos. 0 to 18 " " .....dis 65&5
Tinned market Nos. 0 to 18.....d. s 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 12 to 14.....dis 75
Stub's Steel Wire, regular.....$6.00@lb dis 3

Wrenches.

Coe's genuine.....dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 3
Bemis & Call's Combination.....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 25
William's " " .....dis 25
Alligator " " .....dis 50

Webster, Camp & Lane Machine Co.



MANUFACTURERS OF

Mining Machinery,

Improved Band Friction Hoisting Machinery, Geared or Direct Acting, for round or flat rope.

Wire Rope Haulage Machinery,

Endless or Tail Rope Systems.)

CORNISH PLUNGER AND BUCKET LIFT PUMPS.

Automatic or Slide Valve Steam Engines, Sheaves. Cages, Buckets, Etc.

Send for Catalogue D. 134 N. Main St., AKRON, OHIO.

TIME IS MONEY!

SAVE TIME AND MONEY BY USING OUR SPECIALTIES.

OUR **Time Stamps** A M

Mark the hour and minute, the day, month and year, by one impression.

Useful, Economical, Ornamental.

PRINTED MATTER ON APPLICATION.

OUR **Time Registers**

Record the hour and minute of the arrival and departure of employes by their own act, in their own handwriting.

Indispensable for employers and just to employes.

THE AUTOMATIC TIME STAMP AND REGISTER COMPANY

No. 71 Sudbury St., Boston, Mass., U. S. A.

THE THOS. D. WEST FOUNDRY. CO.

CLEVELAND. O.

LIGHT AND HEAVY

IRON CASTINGS.

DAILY MELTING CAPACITY 75 TONS-SPECIAL FACILITIES FOR ECONOMICALY TURNING OUT SMOOTH CLEAN CASTINGS. DUPLICATE WORK A SPECIALTY

F. A. SACKMANN,

125 Champlain Cleveland, O.

Steel Name Stamps (1-16, 3-32 or ¼ inch letters, 15c. per letter

Eastlake Metallic Shingles.

Unequaled for ROOFING AND SIDING.

Manufactured by W. J. BURTON & CO.'s Galvanized Iron Cornice Works, Detroit, Mich.

Send for illustrated catalogue and prices.

Mention this paper.

UNION ELECTROTYPE FOUNDRY

TELEPHONE 2139

829 SHERIFF ST. CLEVELAND O.

SECTION OF CONVEYOR.

Detachable Roller and Chain Belting,

MADE IN ALL SIZES OF

Malleable Iron and Steel,

DESIGNED FOR

Elevators, Conveyors, Drive Belts, etc.

For handling materials of all kinds.

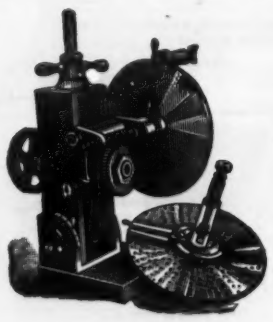
Send for Illustrated Catalogue. Address

The Jeffrey M'f'g Co.,

183 East 1st Ave.,

COLUMBUS, O.

CHAIN Chicago Office, 48 S. Canal St.



Palmer's Gear Cutting Attachment

CAN BE USED ON ANY SCREW-CUTTING LATHE FOR

Amateurs, Clock Makers, Model Makers, Knitting Machine Makers, Tool Makers,

Or any one having use for SMALL GEARING.

For particulars, address

PALMER, CUNNINGHAM & CO., L't'd,

607 Market St., PHILADELPHIA, PA.

IRON FOUNDRY CANTON IRON FOUNDRY CO., Canton, Ohio. HEAVY AND LIGHT CASTINGS. Privilege to make estimates solicited.

THE BRIGHTMAN STOKER IS THE BEST
STEAM BOILER FURNACE IN THE WORLD.
SEND FOR DESCRIPTIVE PAMPHLET. THE BRIGHTMAN STOKER Co. 201-203 RIVER ST. CLEVELAND, OHIO.

HARDWARE MARKET.

Augers and Bits.

Common augers and bits.....dis 70
Snell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ℔ dos., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ℔ dos., $48.....dis 20&10
Gimlet bits, common.....per gross $3 25@4 00
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....℔ doz $7 00
Others.....℔ doz $6 00
Full polished.....℔ doz $8 00

Bolts.

Cast iron barrel bolts.....dis 70
Cast iron shutter bolts, etc.....dis 70
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70
Wrought iron square bolts.....dis 70
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 75&10
Tire, common, new list.....dis 65
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 60
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 75&10
Cast brass, loose joint.....dis 33⅓
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60
Fast joint, broad.....dis 50&10@60
Loose joint.....dis 70&10
Loose joint, jap.....dis 70&10
Loose joint, jap. with acorns.....dis 70&10
Loose pin, acorns.....dis 70&10
Loose pin, japanned acorns.....dis 70&10
Loose pin, acorns, jap. plated tips.....dis 70&10
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10
Wrought, fast joint, broad.....dis 70&10
Wrought, loose joint, broad.....dis 70&10
Table Butts, back flaps, etc.....dis 70&10
Regular inside blind.....dis 70&10
Light inside blind.....dis 70&10
Loose pin.....dis 70&10
Light loose pin.....dis 70&10

Carbonized Felt and Building Papers.

(POWERVILLE BRAND.)

	Per roll of 500 sq. feet.
Eberts Bros., Detroit.	
No. 1—Slaters'	$1.25
"A," Stringed Roofing, Light.	1.50
"B," Stringed Roofing, Medium	1.75
"C," Stringed Roofing, Heavy	2.00
Stringed, Rosin-Sized	1.00

MISCELLANEOUS.

Asphaltum, Trinidad Refined, ℔ ton	$30.00
Asphaltum, Fine Grade, ℔ lb	.08
Coal Tar Felt, 1 Ply, ℔ lb	.02
Coal Tar Felt, 2 Ply, ℔ roll 108 sq ft	1.42½
Coal Tar Felt, 3 Ply, ℔ roll 108 sq ft	1.85
Roofing Pitch, ℔ gal	.09

Chains.

Revised List.
Trace, 6½-10-2.....℔ pair 1.03
Trace, 6½-10-3.....℔ pair .92 } .....50&10
Trace, 7-10-2.....℔ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887.....dis 50&10@60
Galvanized Pump Chain.....℔ lb 5½@6
Jack Chain, Iron.....dis 75&10
Jack Chain, Brass.....dis 75

Chisels.

Socket Framing and Firmer.....dis 75
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Fibre Ware—Standard.

	Nos. 1	5.	5X.
Pails, water, 12 qt	$4 00	$4 50	$.....
Dairy, 14 qt	4 50	5 00	.....
Fire 12 qt	5 00	.....	.....
Sugar	6 00	6 50	.....
Horse	.....	5 00	.....
Buggy	4 00	.....	.....
Chamber, Slop, Commode } 5 and 5X 14 qt.	6 50	7 50	8 50
Pans, slop, 5 and 5X 14 qt	8 00	9 00	10 00
Basins, wash—			
10½ inch	2 00	2 25	.....
12 inch	2 25	2 75	3 25
13½ inch	2 75	3 25	3 75
15 inch	3 25	3 75	4 25
Bowls, fruit	.....	2 50	.....
Servers, 12 in	.....	2 25	.....
Baskets, waste paper, 13 in	.....	6 00	.....
Spittons, "Daisy," pressed			
8 inch	4 00	4 50	5 00
10 and 11¾ inch	6 00	6 50	7 50

No. 1 plain; No. 5 decorated; No. 5X White decorated.

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....℔ gross $12, dis 25@25&5

Hanger

Barn door, old patterns.....dis 60&10&10@70
Climax, (Anti-Friction).....dis 55
Scranton.....dis 33—
Kidder's.....dis 50&10@60
Terry's Patent.....3 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

No.	10	9	8	7	6	
Ausable, ℔ lb.	23	24	25	26	28	dis 40
Putnam, ℔ lb.	18	19	20	21	23	dis 15
Essex						dis 25&10

Horse Shoes.

Burden, at factory.....℔ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....℔ keg $4 00
Mule Shoes, at factory.....℔ keg $5 00

Knobs.

Carriage, japanned.....℔ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hemacite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbin, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60&10
Escutcheons and keys.....dis 60&10
Padlocks and padlock keys.....dis 75
Bell pulls, mineral, porcelain and jet dis 60&10
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 70
Letter box plates, genuine bronze....dis 60&10
Barn door locks.....dis 33⅓
Bishop's Buckeye Sash Locks.....℔ gross $4.80

Plumbs and Leve s.

Standard list.....dis 70&10
Pocket levels.....dis 70&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@00
Pitcher spout, best makers dis 60&10@60&10&10
Pitcher spout, cheaper goods.....dis 70@70&5

Pokes, Animal.

Bishop's I. X. L.....℔ doz $6 00
Bishop's O K.....℔ doz $5 25
Bishop's Pioneer.....℔ doz $3 75
Bishop's American.....℔ doz $2 75

Rakes.

Cast steel.....dis 70
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@$4...dis 10
Rifle razor.....dis $9 50 net

Rat Killers.

Schuyler's.....℔ gross $15 00

Scales.

Hatch, Counter, No. 171.....℔ doz $21 00
Hatch, Tea, No. 161.....℔ doz $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....℔ doz $18 dis 25

Squares.

Steel and iron, Nickel plated } dis 75&10@80
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

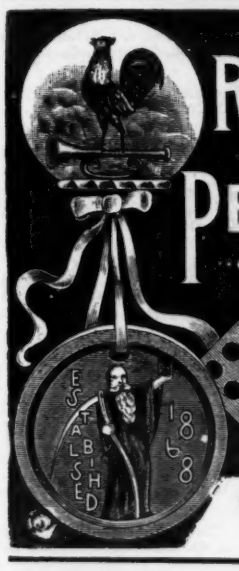
Tacks, Brads, Etc.

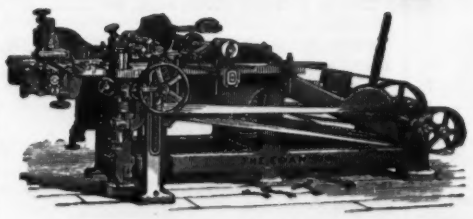
New List, Oct. 19, 1890.

American iron carpet tacks all kinds	dis 77½&10
Steel carpet tacks all kinds	dis 75&10
Swedes iron carpet tacks, all kinds	dis 75&10
Swedes iron tacks	dis 75&10
Swedes iron Upholsterers' tacks	dis 75&10
Tinned Swedes iron tacks	dis 77½&10
Tinned Swedes iron Upholsterers' tacks	dis 77½&10
American iron cut tacks	dis 77½&10
Copper tacks	dis 40&10
Copper finishing and trunk nails	dis 50&10
Cigar box nails	dis 50&10
Finishing nails	dis 60&10
Hungarian nails and miners' tacks	dis 60&10
Gimp and lace tacks	dis 77½&10
" " " tinned	dis 60&10
Trunk and clout nails	dis 72½&10
Tinned trunk&clout nails	dis 66&10
Basket nails	dis 66&10
Chair nails	dis 66&10
Common and patent brads	dis 66&10

FREIGHT AND PASSENGER
ELEVATORS.
L. S. GRAVES & SON,
Main Office and Works, ROCHESTER, N. Y.
BRANCH OFFICES:
NEW YORK, 92 and 94 Liberty St.; BOSTON, 113 Devonshire St.; St. LOUIS, 301 Roe Building
DETROIT, Hodges Building.
SEND FOR CATALOGUE.

RUBBER GOODS
PACKING, BELTING, HOSE, GASKETS, ETC.
Fuller Bros.,
AGENTS
JEWELL LEATHER BELT, and REVERE RUBBER CO.
148 SUPERIOR STREET, CLEVELAND.


THE ROBERT AITCHISON PERFORATED METAL CO.
CHICAGO, ILL.
ESTABLISHED 1868
PERFORATED METALS OF ALL KINDS
OFFICE 510---265 to 269 DEARBORN ST.
WORKS AT SOUTH CHICAGO.

THE ECAN CO.,
Nos. 251 to 271 W. Front St., CINCINNATI, OHIO.
Builders and Originators, Designers and Constructors.
Wood-Working Machinery.

New "Standard Molder, Four Sided.
4, 6, 7, 8, 9, 10 and 12-inch.
Geared feed rolls, two above and two in table. Slotted steel heads.
For Every Purpose
Meeting the requirements of
PLANING MILLS,
SASH, DOOR and BLIND FACTORIES.
PATTERN SHOPS,
General Wood-workers etc.
With the latest and most advanced type of machines for fast and perfect work.
Send for Catalogue and information.

AKRON CHEMICAL CO.,
Imperial Car and Bridge Paints.
PAINTS.
Black Asphaltum Paints. All grades.
150 State Street, AKRON, O.

Classified List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks.

PAGE

Aluminum—
*Stan Aluminum Co., Canton, O..... 12
Automatic Sprinklers—
*Neracher Sprinkler Co., Warren, O..... 8
Belting—
Fuller Bros., Cleveland..... 15
Bolts and Bolt Machinery—
Upson Nut Co., Cleveland..... 16
Boilers and Boiler Attachments—
Babcock & Wilcox Co., New York..... 20
Wm. B. Pollock & Co., Youngstown, O..... 18
E. H. Jones & Co., Cleveland..... 18
Hazelton Tripod Boiler Co., Chicago..... 18
N. Y. Central Iron Works, Geneva, N. Y.. 16
Enterprise Boiler Co., Youngstown, O..... 20
The Stirling Co., Barberton, O..... 11
Blowers—
W. H. LaFountaine, Cleveland, O..... 18
Bicycles—
*A. W. Gump & Co., Dayton, O..... 16
Boiler Solvents—
The Dearborn Drug & Chemical Co..... 9
Coal and Coke—
Pittsburgh & Wheeling Coal Co., Cleveland..... 13
Cranes and Derricks—
Wm. Tod & Co., Youngstown, O 18
Chain Belting—
Jeffrey Mfg. Co., Columbus O..... 14
Carpet Cleaning & Laundry Machines —
W. H. LaFountaine, Cleveland O..... 18
Civil Engineers and Architects—
F. Felkel, Cleveland, O..... 16
Cupolas—
Victor Colliau, Detroit, Mich..... 12
Corrugated Steel—
*Cincinnati Corrugating Co., Piqua, O..... —
Drilling Machines—
Universal Radial Drill Co., Cincinnati, O.. 16
Drop Presses—
Toledo Tool & Machine Co., Toledo, O..... 18
Desks—
Cleveland Desk Co., Cleveland..... 13
Elevators—
L. S. Graves & Co., Rochester, N. Y..... 15
Explosives—
Hercules Powder Co., Cleveland..... 18
Electrical Manufactures—
†Cleveland Electrical Mfg. Co., Cleveland —
Central Thomson-Houston Co..... 10
Edison General Electrical Co., N. Y..... 12
Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill..... 20
Engravers and Electrotypers—
Eclipse Electrotype & Engraving Co., Cleveland..... 17
Union Electrotype Foundry, Cleveland.... 14
Engines (Steam)
*Chandler & Taylor Co., Indianapolis, Ind. 12
Wm Tod & Co., Youngstown, O..... 18
E. H. Jones & Co., Cleveland..... 18
Buckeye Engine Co., Salem, O..... 20
Skinner Engine Co., Erie, Pa..... 19
Westinghouse Machine Co., Pittsburgh... 19
Ball & Wood Co., Elisabeth, N. J..... 19
Southwark Foundry & Machine Co., Philadelphia, Pa..... 19
*The Leffel Water Wheel & Engine Co..... 11
Geo. Place, New York..... 19
Engines (Gas)—
Schleicher, Schumm & Co., Philadelphia, Pa. and Chicago, Ill..... 18
Van Dusen Gas Engine Co., Cincinnati, O..... 17
Engineers and Contractors—
E. H. Jones & Co., Cleveland..... 18
Ejectors—
James Jenks, Detroit, Mich..... 12
Files, Makers of—
Reynolds Bros., Columbus, O..... 20
A. & H. Gough, Cleveland..... 12
Parkin & Bosworth Co., Cleveland..... 20
Forges—
Cleveland City Forge & Iron Co., Cleveland 20
Foundries—
Thos. D. West. Foundry Co., Cleveland..... 14
Canton Iron Foundry Co., Canton, O..... 14
Furnace Feeders—
Brightman Stoker Co., Cleveland..... 15
Foundryman's Crayon—
J. B. Lippincott Co..... 16
For Sale, Wants, etc.—
J. von Langer..... 16
W. W. Marmaduke..... 16
The James Leffel Co..... 12
Galvanizers.
*H. H. Hodell, Cleveland..... 18
Gear Cutters—
Palmer, Cunningham & Co., Philadelphia, Pa..... 14
Grapples, Excavators and Dredges—
Jas. H. Lancaster, New York..... 17
Graphite Paint—
Jos. Dixon Crucible Co., Jersey City..... 12
Granulated Raw Bone—
The Rogers & Hubbard Co., Middletown. 11
Heating and Ventilating Apparatus—
W. H. LaFountaine, Cleveland, O..... 18
Hangers—
W. H. LaFountaine, Cleveland, O..... 18
Heaters and Purifiers—
Stilwell & Bierce Manufacturing Co., Dayton, O..... 20
W. H. Jones & Co., Cleveland..... 18
*Warren Webster & Co., Philadelphia, Pa 20
Hammers (Power)—
Hackney Hammer Co., Cleveland..... 10
Harness Specialties—
Buffalo Specialty Co., Buffalo, N. Y..... 17
Investments—
W. N. G., Cleveland..... 12
Muskegon Improvement Co..... 16
Iron and Steel Roofing—
Sykes Iron & Steel Roofing Co., Niles, O... 19
Cambridge Iron Roofing Co., Cambridge, Ohio..... 19
Garry Iron Roofing Co., Cleveland..... 19
*Berger Mfg. Co., Canton, O..... —
Eberts Bros., Detroit, Mich..... 20
Kanneberg Roofing Co., Canton, O..... 19
*The Long Steel and Iron Roofing and Corrugating Co., Indinapolis..... —
J. H. Eller & Co., Canton, O..... 19
W. J. Burton & Co., Detroit, Mich..... 14
Holton Iron Roofing Co , New Lisbon, O... 19
‡Heberling Metal Roofing Co., Havana Ill. —
Iron Ore, Bar and Pig Iron—
Dalliba, Corrigan & Co., Cleveland..... 13
Oglebay, Norton & Co., Cleveland..... 13
J. H. Outhwaite & Co., Cleveland..... 13
Condit-Fuller Co., Cleveland, O..... 13
E. C. Pope, Cleveland..... 13
Cleveland Iron Mining Co., Cleveland..... 13
Injectors—
Penberthy Injector Co., Detroit, Mich..... 20
*Garfield Injector Co., Wadsworth, O..... —
Lathes—
H. L Shepard, Cincinnati, O..... 11
Parkin & Bosworth Co., Cleveland..... 20
Lathe Dogs—
Palmer, Cunningham & Co., Philadelphia 14
Mining Machinery—
Webster, Camp & Lane Machine Co., Akron, O..... 14
*Copeland & Bacon, New York..... —
Machine Shops—
Webster, Camp, & Lane Machine Co., Akron, O..... 16
Toledo Machine & Tool Co., Toledo, O..... 18
Machinists' Tools and Supplies—
Parkin & Bosworth, Co., Cleveland.....16 &20
Garvin Machine Co., New York..... 12
Metal Ceilings—
Fred F. Bischoff, Chicago, Ill..... 12
Merchandise Brokers—
L. H. Oldfield, Wichita, Kan..... 11
Patents—
*Munn & Co., New York..... —
W. T. Fitzgearld, Washington, D. C..... 11
Pumps (Steam)—
E. H. Jones & Co., Cleveland..... 18
Deming Co., Salem, O..... 18
Paint—
Iron Clad Paint Co., Cleveland, O..... 12
Akron Chemical Co., Akron. O..... 15
Jos. Dixon Crucible Co., Jersey City..... 12
Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill..... 13
Aitchison Perforated Metal Co., Chicago. 15
Pipe Cutting & Threading Machines—
*Wells Machine Works, Fostoria, O..... 12
Railroads—
Time Tables, Etc..... 17
Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland..... 20
Rock Breakers and Ore Crushers—
Jas. H. Lancaster, New York..... 17
Totten & Hogg, Pittsburgh, Pa..... 11
Rubber Goods—
Fuller Bros., Cleveland..... 15
Rolls and Pinions—
Totten & Hogg Iron & Steel Foundry Co., Pittsburgh, Pa..... 11
Saws—
Peter Gerlach & Co., Cleveland..... 13
Shafting—
*Brightman Machine Co,, Cleveland..... —
Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn..... 11
Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland..... 16
F. A. Sackman, Cleveland, O..... 14
Jas. Murdock Jr., Cincinnati, O..... 16
Sheet Iron—
Cleveland Rolling Mill Co., Cleveland....13, 16
Cambridge Iron & Steel Co.,Cambridge,O 13
Steel Castings—
Chester Steel Casting Co., Philadelphia, Pa..... 19
Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland....13, 16
Sheet Steel—
Cambridge Iron & Steel Co.,Cambridge, O 13
Stokers—
Brightman Stoker Co., Cleveland 15
Steam and Hot Water Heaters—
Hazelton Tripod Boiler Co., Chicago..... 18
Steel Laths—
Bostwick Steel Lath Co., Niles, O..... 11
Twist Drills—
Cleveland Twist Drill Co.. Cleveland..... 20
Graham Twist Drill Co., Detroit, Mich..... 20
Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland..... 20
Time Registers—
The Automatic Time Stamp and Register Co , Boston, Mass..... 14
Water Gas Furnaces—
W. S. Hutchinson, Chicago, Ill..... 20
Window Blinds—
Hartman Sliding Blind Co., Wooster, O... 16
Wood-Working Machinery—
*Indiana Machine Work, Ft. Wayne, Ind 12
Geo. Place, New York, N. Y..... 19
Frank & Co., Buffalo, N. Y..... 18
The Egan Co., Cincinnati, O..... 15
Wire Goods—
*F. Powell & Co., Toledo, O..... 20
Wire Machinery—
John Adt & Son, New Haven, Conn..... 17
Well Sinking Machinery—
American Well Works, Aurora, Ill..... 20
Washers—
Milton Mfg. Co., Milton, Pa..... 12

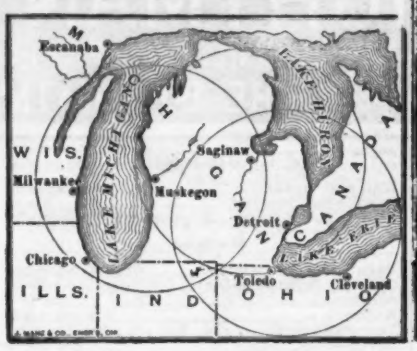
LOOK AT THIS YOU WILL BE SURPRISED AT The Facts About MUSKEGON

These Three Circles **3 Circles** Have each a radius of 125 miles.

Each has, in round numbers population viz:
SAGINAW CIRCLE - - 1,725,000
DETROIT CIRCLE - - 2,600,000
MUSKEGON CIRCLE - 2,725,000

For proof, see Cram's Atlas, Census 1890, by counties.

OBJECT LESSON.



FROM THIS YOU WILL UNDERSTAND **WHY MUSKEGON** IS ABLE TO GET SO MANY NEW FACTORIES—**21** IN LAST 18 MONTHS AND MORE COMING. IT MAY ALSO GIVE YOU A *Pointer* ABOUT INVESTMENTS.

There will be one large city on the east shore of Lake Michigan, AND THAT PLACE WILL BE **MUSKEGON.**

NAVIGATION OPEN THE YEAR ROUND WITH CHICAGO AND MILWAUKEE.

MUSKEGON CIRCLE NOT ONLY HAS MORE PEOPLE BUT CAN REACH THE BEST WESTERN MARKET BY WATER THE YEAR ROUND.

PROPERTY LOW. SPLENDID OPPORTUNITIES TO DOUBLE AND TREBLE YOUR MONEY. SEND YOUR ADDRESS FOR MAPS, PLATS, ETC., TO

HOLBROOK & McDONALD,
Sales Agents MUSKEGON IMPROVEMENT CO.

THE VON LANGER ENGINEERING AND WATER GAS COMPANY, LIMITED, Leeds, England. Mr. Joseph von Langer, M. I. E. A. V., managing director of the above company, recently manager of the Leeds Steel Works, Limited, Leeds, England and many years sub-manager of the steel department of the Iron and Steel Works, Witkowitz, Austria, intends to pay a second visit to the States in September or October and will be glad to open communication with those firms who are intending to erect Basic Steel Plant for open hearth or Bessemer work. Special Open Hearth Furnaces using 50 per cent. less fuel than ordinary type. The Pietzka Patent Puddling Furnaces using 70 per cent. less fuel than ordinary furnaces. See Dr. Weddings paper read at the Iron & Steel Institute, New York, 1890.

FOUNDRY AND MACHINE SHOPS For Sale

In this city. Fine location, making money, cheap fuel and is fine opening for experienced man. Price low. Good reasons for selling. Will bear investigation,

W. W. MARMADUKE,
Washington, Ind.

FOUNDRYMAN'S CRAYON.

Natural White Soapstone.

75 cents per hundred. Send for Sample.

J. B. LIPPINCOTT CO.,
715-717 Market St., PHILADELPHIA.

Keep a Record of Your Insurance

By ordering one of our Improved

Expiration Registers.

Blanks for all the essential points of each policy.

ONLY 50 CENTS (Postage paid).

Will last for years. Sample leaves sent on application. Address

The Cleveland Printing & Publishing Co.

27, 29 and 31 Vincent Street,

CLEVELAND, O.

CLEVELAND BUSINESS DIRECTORY.

F. FELKEL,
CIVIL ENGINEER AND ARCHITECT,
155 ST. CLAIR ST., CLEVELAND, O.
IRON BUILDINGS, LARGE SPAN ROOFS.
PLANS for Manufacturing Plants, Warehouses and other Heavy Structures a SPECIALTY.

Bolt and Nut Works.

THE UPSON NUT CO, Manufacturers of Nuts, Washers, Carriage, Machine, Plow and Elevator Bolts, Coach Screws, etc.

Hardware and Iron.

CLEVELAND ROLLING MILL CO., manufacturers of Steel and Iron Wire and Steel Tire.

Machinists' Supplies.

PARKIN & BOSWORTH, 9 and 11 So. Water St., dealers in Manufacturers' Supplies, Machinery and Tools.

Steel Stamps and Stencils.

FLEHARTY, J. H. & CO., Rubber Stamps, Seals, Stencils, Automatic Check Punches and Numbering Machines. 92 Seneca St.

BOSINESS DIRECTORY.
Akron, O.

WEBSTER, CAMP & LANE MACHINE CO., Founders and Machinists, 12 Main st.

Save Money. Before you buy a **BICYCLE** send for prices to **A. W. GUMP & CO., Dayton, O.**
New Bicycles at reduced prices, and 400 second-hand ones, *Difficult Repairing.* Bicycles, Guns and Type Writers taken in exchange.
Boys' or Girls' 24-in Safety, with rubber tires, $15.00.
Boys' 28-inch Safety, with rubber tires - - 17.50.
Gents' 31-inch Safety, balls to b'g's and pedals, 55.00.

JAS. MURDOCK, JR.
Manufacturer of
STEEL STAMPS
NAME PLATES,
& TIME & TOOL ROOM CHECKS.
NILES TOOL WORKS 25
52 Longworth St, Cincinnati, O

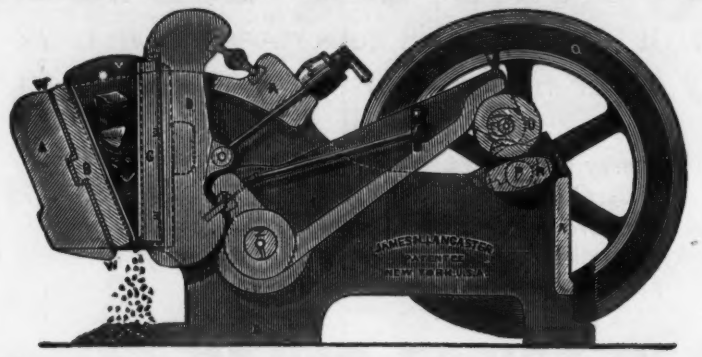
UNIVERSAL RADIAL
RADIAL DRILLING MACHINES
THREE DESIGNS. SIX SIZES
EMBODY ALL DESIRABLE FEATURES
PRICES $450.00 & UPWARD
ADDRESS UNIVERSAL RADIAL DRILL CO
CINCINNATI, O. U.S.A.

Tens of thousands of these blinds are in use. Agents wanted; Send 4-cent stamp for an 80-page illustrated catalogue to

HARTMAN SLIDING BLIND CO.,
89 Beaver St., WOOSTER O., U. S. A

The "Lancaster" Rock Breaker and Ore Crusher

The Strongest, Simplest, Cheapest and the Most Perfect Crusher Made.



Instantly adjustable to yield any desired uniform grades of product.

Half the power only required and is less liable to breakage, and less in first cost and also in subsequent wear and tear, and less weight than any rival's breaker. For crushing rock for macadamizing and concreting purposes, and also for reducing ores, these breakers are specially efficient.

The "Lancaster" Crushers are also made in "Sections" for easy transportation in mountainous regions. May be mounted on wheels, worked by hand, horse gear and steam or other power, and also fitted with Rotary Screens, Elevators and Conveyors. Correspondence and trial tests solicited.

THE "LANCASTER"

Will automatically dig, raise and discharge mud, clay, gravel, sand, hard pan ores, rock phosphates and fire-clay from their beds and banks, and also load and unload vessels or barges with sand, coal, ores, grain and other materials. These Grapples are made of best forged steel, with four penetrating scoops, operated solely by compound leverage, thus dispensing with the inside sheaves, drums, catches, gears, chains and friction, found in all rival buckets. They may be worked by the "Lancaster" hand or horse-power, hoisters, or by any maker's double drum hoisting engines.

Send for our new illustrated price list, agency terms and testimonials, and make appointment to see our Rock Breakers, Grapples, Hand, Horse and Steam Power Hoisters at work. Comparison of our prices, capacities and merits with all rival Grapples. Rock Breakers, Hoisters, etc., earnestly solicited.

Self-Penetrating Grapple, Excavator and Dredger.

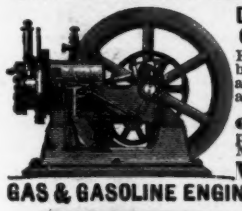
Correspondence solicited. Manufactured and sold by the patentee.

THE CONLEY-LANCASTER" DIRECT STEEL PROCESS.

JAMES H. LANCASTER. (P. O. BOX 3139) 169 AND 172 BROADWAY. NEW YORK, U. S. A.

GAS and GASOLINE ENGINES

STATIONARY and PORTABLE. All Sizes.



Dwarfs in Size, but Giants in Strength.

Expense one cent an hour per horse power and requires but little attention to run them. **Every Engine Guaranteed.** Full particulars free by mail Mention this paper.

VAN DUZEN GAS & GASOLINE ENGINE CO. Cincinnati, O.

Elastic Rotary-Blow Riveting Machine.

JOHN ADT & SON,

NEW HAVEN, CONN.

Builders of Machinery for Hardware Manufacture.

AUTOMATIC

Wire Straightening and Cutting Machines,

BUTT MILLING MACHINERY,

Butt Drilling Machinery,

Riveting Machines.

Foot Presses,

Sprue Cutters, Etc.

Just Drive 'Em In and CLINCH 'Em.

THEY'LL DO THE REST.

Rapid HARNESS MENDERS.

WILL MEND

Any Harness, Halter or Strap in less time, and do the work better than any Harness maker can, AND

COSTS ONLY HALF A CENT

Sold by Grocers and Hardware Dealers Cost only 25c per box of one gross (three sizes.)

NO TOOLS REQUIRED

BUFFALO SPECIALTY MFG. CO., BUFFALO, N. Y.

Wheeling & Lake Erie Railway.

THE NEW THROUGH LINE

BETWEEN

TOLEDO

—AND—

Steubenville, Pittsburgh, Marietta.

THROUGH COACHES

BETWEEN

Toledo & Marietta.

Through Sleepers Between

PITTSBURGH AND CHICAGO.

AND DAY COACHES BETWEEN

Toledo and Pittsburgh, Via Akron, Cuyhoga Falls, Kent, Ravenna, Leavittsburg, Warren, Niles, Girard, Youngstown, New Castle and Allegheny.

The Only Line running through

"BEAUTIFUL ZOAR."

A. G. BLAIR, Traffic Manager. JAS. M. HALL, Gen'l Pass. Agent.

TRAVELERS' REGISTER.

Standard Time.

Erie Railway.

Depot and Viaduct.

	Arrive.	Depart.
[illegible]	†5 38 a m	*8 25 a m
[illegible]	*10 55 a m	*3 00 p m
[illegible]		†6 40 a m
Pit[illegible]	†6 25 p m	
You[illegible]	†6 05 a m	
Maho[illegible] cal		*11 40 a m
Maho[illegible]		†4 30 p m
Pittsbu[illegible]	†1 20 p m	11 10 p m
New Yo[illegible]	*8 00 p m	

*Daily. ‡except Sunday. ‖Daily except Mond[illegible]

C[illegible] Canton Railroad.

(Standard Gauge.)

Depart for—

Zanesville a[illegible] hocton—6:50 a. m., 3:00 p. m.
Canton—6:50 [illegible]., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. [illegible]:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 [illegible]., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p[illegible], *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:[illegible]a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p[illegible], 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.

Arrive from—

Zanesville and Coshocton—10:30 a. m.,6:30 p m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.

Trains marked * run daily.

Valley Railway.

FOR AKRON, CANTON AND MARIETTA.

Depot oot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.....	*7 25 a m	*6 40 p m
Marietta Express.....	†11 15 a m	†2 35 p m
Balto. & Wash. Express....	*4 00 p m	*10 25 a m
Cleve. and Canton Express	†6 30 p m	†8 15 a m

*Daily. †Daily, except Sunday.

J. T. JOHNSON, Gen. Supt. J. B. CAVEN, Gen. Pass. Agt.

From Cleveland Union Station.

PENNSYLVANIA LINES.

Cleveland & Pittsburgh R. R.

	Arrive.	Depart.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	d5 25 a m d11 40 a m 6 35 p m	7 45 a m d1 40 p m d11 10 p m
Wellsville, Wheeling and Bellaire.	12 30 p m 6 35 p m	7 45 a m 1 05 p m
Alliance Accom.	10 10 a m	3 25 p m
Ravenna Accom.	8 25 a m	5 00 p m

d Daily. *Except Saturday. Other trains except Sunday. Through Pullman Sleepers to New York on 1:40 p. m. train daily.

From Cleveland Union Station.

Mt Vernon and Pan Handle Route

Cleveland & Pittsburgh R. R.

	Arrive.	Depart.
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon, Columbus, Xenia, Dayton, Cincinnati, Louisville, Indianapolis, St. Louis, and all points in the South and Southwest	d 7 00 am 5 40 p m	8 00 a m d 8 00 p m
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon and Columbus.	12 30 p m	1 05 p m
For Cuyahoga Falls, Akron, Orrville, Chicago, and all points in the West and Northwest.	5 40 p m 10 10 a m	8 00 a m 3 25 p m

d Daily. Other trains except Sunday.

Pullman Palace Sleeping Cars daily between Cleveland, Columbus and Cincinnati City ticket office, Weddell House corner.

FT. WAYNE, CINCINNATI & LOUISVILLE RAILROAD.

The Popular Route Between the

NORTH and SOUTH

The Direct Route to or from

Fort Wayne, Indianapolis, Terre Haute, Evansville and St. Louis.

13 MILES SHORTER BETWEEN **13**

Fort Wayne and Indianapolis,

Than any other Route.

22 MILES SHORTER AND QUICKER **22**

BY THREE HOURS, BETWEEN

Louisville and Fort Wayne.

ASK FOR TICKETS VIA

Ft. Wayne, Cincinnati & Louisville R. R.

For sale by all Agents of connecting lines, East, West, North and South.

GEO. W. SAUL, Gen'l Supt. W. H. FISHER, Gen'l Pass. & Tk. Agt.

FORT WAYNE, IND.

PITTSBURGH AND LAKE ERIE RAILROAD.

"Cleveland & Pittsburgh Short Line."

Twenty (20) Miles Shorter than any other route between Cleveland, Pittsburgh, Washington, Baltimore and the South East.

5 Through Trains Daily 5

FAST TIME. NO DELAYS.

"For scenery picturesque and varied,
Through valleys green, 'mong mountains serried,
The people's favorite route I ween,
The P. & L. E. sits enthroned as queen."

See that your tickets read via

THE PEOPLE'S FAVORITE ROUTE.

E. HOLBROOK, Gen'l Supt., A. E. CLARK, G. P. & T. A. Pittsburgh, Pa.

SCIOTO VALLEY RAILWAY.

Direct route, Columbus, O., to Circleville, Chillicothe, Waverly, Portsmouth, Ironton and Ashland, Ky. Three trains daily except Sunday. Favorite route, North and West, making close connection at Ashland, Ky., with the Chesapeake & Ohio Ry., through the canons of New River, passing White Sulphur Springs and the many Summer resorts of the Alleghenies in Virginia.

Shortest and Quickest Route to Richmond, Lynchburg, Newport News, Old Point Comfort.

J. ROBINSON, Receiver, Columbus, O. JNO. J. ARCHER, Gen'l Pass. Agt

—THE—

Cleveland & Marietta Ry.

THROUGH TRAINS

BETWEEN

Toledo, Cleveland and the Ohio River.

The shortest and best Route via Marietta to

Washington, D. C., Charleston, W. Va., Parkersburg, W. Va., and the South.

Direct connections at Union Depots, with all great through lines to all Points

WEST, NORTHWEST, SOUTH, SOUTHWEST AND SOUTHEAST.

Lowest Rates. Quickest Time.

Best Accommodations.

Tickets sold and baggage checked through to destination. Reliable information and best rates will be furnished by any agent of the Popular C. M.

A. T. WIKOFF, Pres. and Gen. Mgr. W. K. RICHARDS, G. P. & T. A

THE FAVORITE

—AND—

PICTURESQUE ROUTE

—TO—

New York, Boston and the East.

The shortest and quickest Route to Pittsburgh, Washington and Baltimore & the South east.

ERIE RAILWAY

New Central Depot So. Water St. and Viaduct

	Depart.
No. 62, Accommodation	† 6 00 a m
No. 72, New York & Pitts. Express	* 8 10 a m
No. 70, Pittsburgh Accom	*11 25 a m
No. 64, New York & Pitts. Limited	* 2 50 p m
No. 66, Mantua Accommo	* 4 20 p m
No. 74, Youngst'n Ex.	† 6 00 p m
No. 68, New York & Pitts. Ex.	*11 00 p m
	Arrive.
No. 61, N. Y. & Pittsburgh Express	† 5 15 a m
No. 71, Youngstown Accom	* 7 15 a m
No. 65, New York & Pitts. Lim.	* 9 55 a m
No. 67, Pittsburgh Accom	*12 30 p m
No. 73, Leavittsburgh Local	* 2 10 p m
No. 63, New York & Pitts. Ex.	* 6 50 p m
No. 75, Mantua Accom.	* 7 20 p m
No. 69, Youngstown Express	† 9 10 p m

*Daily. †Daily, except Sunday.

Baggage checked through to all points East.

Through tickets and information regarding the route can be obtained at office, 141 Superior street, and at Depot N. Y., P. & O. Railroad South Water street and Viaduct, Cleveland.

A. M. TUCKER, Gen. Mang., Cleveland, O.
W. C RINEARSON, Gen. Pass. Ag't, New York
G. K. FOUTS, C P. & T. A., Cleveland.

ECLIPSE ELECTROTYPE ENGRAVING CO. AUST & CLARK PROPRIETORS CLEVELAND

THE HAZELTON TRIPOD BOILER

Furnishes more and dryer steam with less fuel, and generates steam more rapidly, than any other boiler in use.

CLEVELAND REFERENCES.

J. W. Britton, Esq.,
Woods, Jenks & Co.,
W. S. Tyler Wire Works Co.,
Cleveland Forge & Iron Co.,
Bishop & Babcock Co.,
Cleveland Saw Mill & Lumber Co.

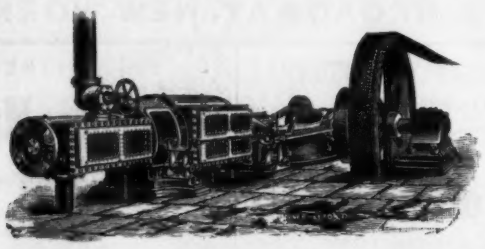
Cherry Valley Iron Works, Leetonia, O.,
Federal St. & Pleasant Valley Pass. Ry., Pittsburgh, Pa.,
Anglo-American Provision Co., Chicago,
Wellsville Plate & Sheet Iron Co., Wellsville, O.,
Falcon Iron & Nail Co., Niles, O.

Address: THE HAZELTON TRIPOD BOILER CO.,

GEO. A. HUMPHREYS, Ag't, 723 Perry-Payne Bldg., CLEVELAND, O. 809 Monon Block, 324 Dearborn St., CHICAGO, ILL.

Who also offer the Hazelton Purifier which we guarantee will remove 90 to 95 per cent. of the impurities from feed-water.

WILLIAM TOD & CO., YOUNGSTOWN, OHIO.



The Porter Hamilton Engine.

Single Compound and Condensing-100 horse-power and upwards.

THE HAMILTON BLOWING EFGINE, HYDRAULIC CRANES, ACCCUMULATORS AND SHEARS.

HEAVY SPECIAL MACHINERY GENERALLY.

SEND FOR ILLUSTRATED CATALOGUE.

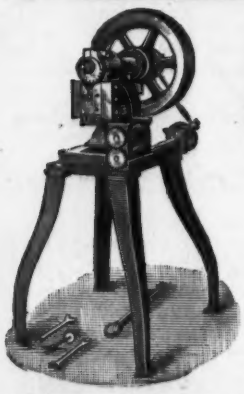
E. H. JONES & CO.,

ENGINEERS AND CONTRACTORS,

223-225 River St., CLEVELAND, O.

Steam Plants Complete. Engines, Boilers, Pumps, Heaters, Etc.
Steam and Hot Water Heating.

STURTEVANT'S BLOWERS, COILS, ETC.,
FOR HOT BLAST HEATING.



THE TOLEDO MACHINE TOOL CO.,

MANUFACTURERS OF

PRESSES, DROP PRESSES, DIES,

AND

Special Machinery

DESIGNED AND BUILT TO ORDER.

Dies for all kinds of sheet metal goods, leather, paper, etc. Inventors' models and specialties. Send for circulars and prices.

St. Clair and Washington Streets.

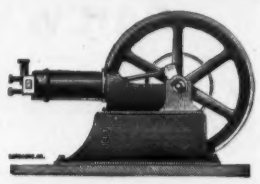
Mention this paper. TOLEDO, O

Otto Gas Engine Works,

SCHLEICHER, SCHUMM & CO., { Philadelphia. Chicago.

Horizontal OTTO Gas Engines.
Vertical OTTO Gas Engines.
Twin Cylinder OTTO Gas Engines.
Combined OTTO Gas Engine Pumps.
Combined OTTO Gas Engine Dynamos.

SIZES: 1, 2, 4, 7, 10, 15, 25 AND 50 HORSE-POWER.



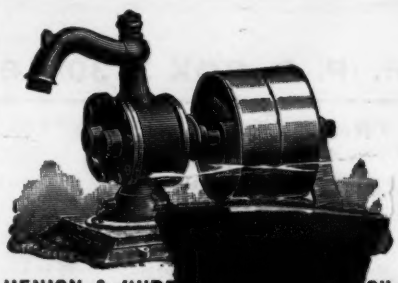
W. H. LaFountaine,

MANUFACTURER OF

VENTILATING FANS AND BLOWERS, HANGERS,

Carpet Cleaning and Laundry Machinery and other Special Machinery.

1335 Lexington Ave., • CLEVELAND, O.



THE DEMING CO.,

SALEM, OHIO.

Pumps,

For HAND AND POWER.

Adapted for BOILER FEEDING, FIRE PURPOSES, etc.; also ARTESIAN WELL CYLINDERS and WORKING HEADS for FACTORIES, MILLS and FURNACES.

HENION & HUBE... Clinton St., Chicago, General Western Agents

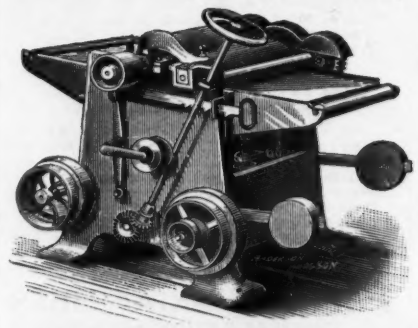
Send fo... ue and price list. Mention this paper.

BOILE...
MAHONING BOILER WORKS.
PIPES, STACKS, BEAMS, ROOF TRUSSES, BLAST FURNACES
ROLLING MILL WORK.
WM. E... OLLOCK & CO. YOUNGSTOWN, O.

FRANK & CO., BUFFALO, N. Y.

MANUFACTURERS OF

Band Saws, Scroll Saws, Universal Saw Benches,



Saw Mandrels, Pony Planers,
Matchers, Friezing Machines,
Shafting, Pulleys, Hangers,
Couplings, Wood Turning and
Pattern Makers' Lathes.

WOOD WORKING MACHINERY.

HERCULES POWDER

SEND FOR DESCRIPTIVE PAMPHLET.

Stump before a blast. | Fragments after a blast.

STRONGEST and SAFEST EXPLOSIVE
Known to the Arts.

POWDER, FUSE, CAPS,

Electric Mining Goods,

AND ALL TOOLS FOR STUMP BLASTING.
FOR SALE BY THE
HERCULES POWDER COMPANY,
40 Prospect Street, Cleveland, Ohio.
J. W. WILLARD, Manager.

HERCULES,
THE GREAT STUMP AND ROCK
ANNIHILATOR.

THE BALL & WOOD CO.,

Owners of Ball Patents and Builders of

Improved Automatic Cut-off Engines.

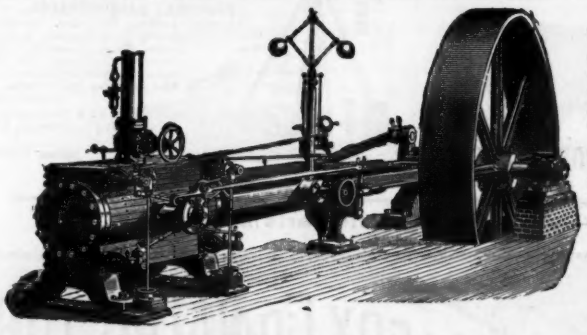
Under the personal supervision of the inventor, F. H. Ball.

Simple Engines, **Electric Lighting Plants,**
Compound Engines, for **Electric Railway Plants,**
Triple Expansion Engines, **Manufacturing Engines,**

And all purposes requiring close regulation and economy.

WORKS, ELIZABETH, N. J. **OFFICE, 15 CORTLANDT ST., N. Y.**

- MACHINERY. -



Iron and Wood Working Machinery of every description; Corliss Engines and Boilers; Shafting, Pulleys and Hangers.

Agent for Bement Miles & Co., Philadelphia, and Eastern Agent for J. A. Fay & Co.

GEO. PLACE,
ESTABLISHED 1855
120 BROADWAY, N. Y.

WESTINGHOUSE ENGINES

A FEW RAILROAD USERS:

	Engines.	Horse-powers.
Ashland Coal & Iron Railroad Co	1	60
Baltimore & Ohio Railroad Co	6	190
Boston & Albany Railroad Co	2	130
Camden & Atlantic Railway Co	3	75
Central Railway of New Jersey	4	275
Chicago & Erie Railway Co	2	30
Chicago, Burlington & Quincy Railroad Co	3	175
Chicago, Milwaukee & St. Paul Railroad Co	5	100
Chicago, Rock Island & Pacific Railroad Co	4	170
Colorado Midland Railway Co	1	25
Denver & Rio Grande Western Railroad Co	3	75
East Tennessee, Virginia & Georgia Railroad Co	3	325
George's Creek & Cumberland Railroad Co	2	50
Grand Trunk Railway Co. of Canada	12	500
Gulf, Colorado & Santa Fe Railway Co	3	135
Kansas City, Wyandotte & Northwestern Railway Co	2	55
Newport News & Mississippi Valley Co	2	200
New York Central & Hudson River Railroad Co	4	125
New York, Lake Erie & Western Railroad Co	2	140
New York, West Shore & Buffalo Railroad Co	6	340
Northern Pacific Railroad Co	2	45
Pennsylvania & Northwestern Railroad Co	1	25
Pennsylvania Railroad Co	51	2330
Peoria & Pekin Union Railroad Co	1	55
Philadelphia & Reading Railroad Co	7	315
Pittsburgh, Cincinnati, Chicago & St. Louis Railway Co	2	20
St. Louis & San Francisco Railway Co	3	260
Southern Railway Co	1	10
Wabash, St. Louis & Pacific Railroad Co	4	60
Washington & Georgetown Railway Co	1	15

Many foreign railroads unreported.

THE WESTINGHOUSE MACHINE COMPANY.
PITTSBURGH, PENNA. U.S. OF A.

SKINNER ENGINE CO., ERIE, PA.

OVER **4500** IN USE.

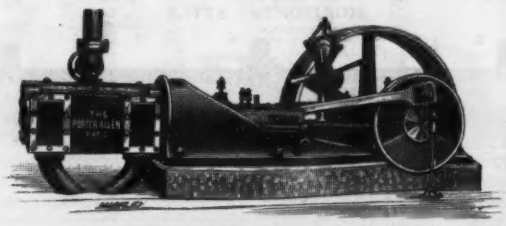
MANUFACTURERS OF

AUTOMATIC, STATIONARY & PORTABLE

ENGINES and BOILERS

SEND FOR CATALOGUE.

SOUTHWARK FOUNDRY & MACHINE CO., Philadelphia, Pa.



SOLE MAKERS OF THE

PORTER-ALLEN AUTOMATIC ENGINE.

ALSO BUILDERS OF

Blowing Engines, **Reversing Engines,** **Hydraulic Cranes,**
Centrifugal Pumps, **Accumulators,** **Boilers Tanks, etc.**

GARRY IRON AND STEEL ROOFING COMPANY,

The Largest Manufacturers of Iron and Steel Roofing in the World,

MANUFACTURERS OF ALL KINDS OF

Iron and Steel Roofing, Crimped and Corrugated Siding, Iron and Steel Tile or Shingle, Fire-Proof Doors and Shutters, Iron Ore Paint and Cement.

Iron Frames for Roofs and Buildings.

No. 152 MERWIN ST., CLEVELAND, O.

Send for Circular and Price List No. A

THE KANNEBERG ROOFING CO., Canton, O.

The Originators of Strictly Genuine Steel Roofing.)

MANUFACTURERS OF THE

Kanneberg Pat., Latest Improved, Folded Lock Seam Roofing,

Made of STRICTLY GENUINE STEEL.

CORRUGATED IRON (four sizes of corrugations), and Crimped Edge Iron Roofing and Siding, Beaded Iron Siding and Ceiling, Water Proof Building Paper, Dry and Ready Mixed Paints, Etc

Write for Catalogues, Price Lists and Samples.

HOLTON IRON ROOFING CO.

ROOFING, SIDING, CEILING &c.

NEW LISBON, O.

AGENTS WANTED EVERYWHERE

CAMBRIDGE ROOFING CO., Cambridge, O. & Chatanooga, Tenn.

Manufacturers of

Plain, Rolled, Crimped Edge, Corrugated and Beaded Roofing, Siding and Ceiling.

PURE STEEL A SPECIALTY

Send for Descriptive Catalogue.

J. H. ELLER & CO.,

—MANUFACTURERS OF—

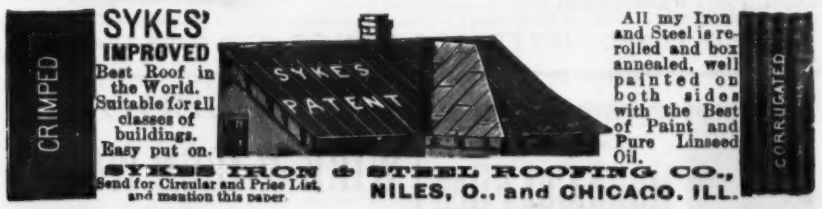
Steel Roofing,

Corrugated Iron,

Crimped Edge Roofing and Siding, Beaded Siding and Ceiling, Patent Slip Joint EAVE TROUGHS, etc.

WRITE US FOR PRICES.

Agents Wanted. **Address OFFICE NO. 223, CANTON, O**


CRIMPED
SYKES'
IMPROVED
Best Roof in the World. Suitable for all classes of buildings. Easy put on.
SYKES
PATENT
All my Iron and Steel is re-rolled and box annealed, well painted on both sides with the Best of Paint and Pure Linseed Oil.
CORRUGATED

Send for Circular and Price List, and mention this paper.

SYKES IRON & STEEL ROOFING CO.,
NILES, O., and CHICAGO, ILL.

STEEL CASTINGS

FROM 1-4 TO 15,000 LBS. WEIGHT.

True to pattern, sound, solid, free from blow-holes and of unequaled strength.

Stronger and more durable than iron forgings in any position, or for any service whatever.

60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel now running prove this.

Crossheads, Rockers, Piston-Heads, etc., for Locomotives. STEEL CASTINGS of every description.

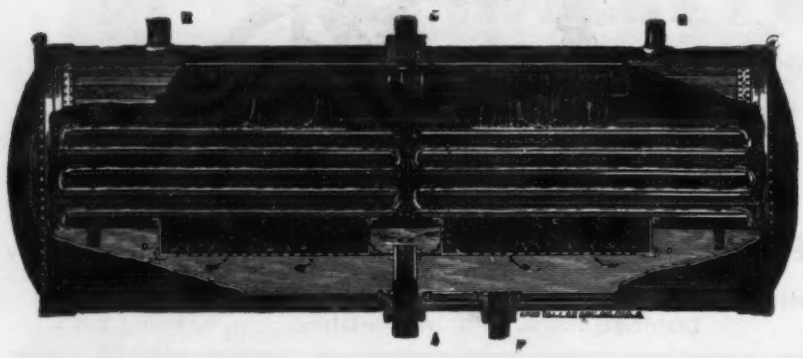
Send for circulars and prices to

Chester Steel Castings Co.,

WORKS: CHESTER, PA. OFFICE 407 LIBRARY ST., PHIADELPHIA, PA.

STILWELL'S PATENT LIVE STEAM-FEED WATER PURIFIER.

(HORIZONTAL STYLE.)



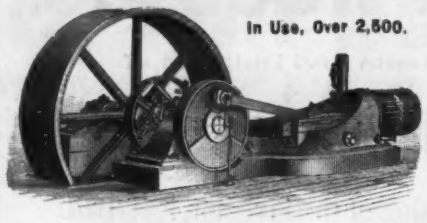
Removes all Impurities. Entirely Prevents Scale in SteamBoilers.

CATALOGUE ON PPLICATION.

STILWELL & BIERCE MANUFACTURING CO.

DAYTON, OHIO.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.



In Use, Over 2,500.

25 to 1,000 H. P.

These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and Superior regulation guaranteed. **Self-contained Automatic Cut-off Engines 12 to 200 H. P. for driving Dynamo Machines a Specialty.** Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail. Address **BUCKEYE ENGINE CO., Salem, O.**

SALES AGENTS:

W. L. SIMPSON, 10 Telephone Building, 18 Cortlandt St., N. Y.

W. N. ROBINSON, 154 Washington St., Chicago, Ill. ROBINSON & CARY CO., St. Paul, Minn.

Water Gas Furnaces

FOR LOCOMOTIVES, STEAMBOATS AND STATIONARY BOILERS.

A Perfect Smoke Burner.

W. S. HUTCHINSON. 6 Washington-st., Chicago

OLD 1874. RELIABLE 1891.

CLEVELAND TWIST DRILL CO.,

SEND FOR CATALOGUE. Cor. Lake & Kirtland Sts., Cleveland, O. WRITE FOR DISCOUNTS.

Works and General Office AURORA.

Branches

LIGHTNING WELL-SINKING MACHINERY MANUFACTURERS.

Hydraulic, Jetting, Revolving, Artesian, Diamond Prospecting Tools, Engines, Boilers, Wind Mills, Pumps. **Encyclopedia,** 1,000 engravings, Earth's Strata, Determination quality water; mailed, 25c.

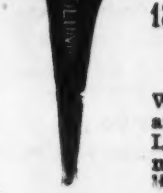
The American Well Works, Aurora, Ill.

11 & 13 S. Canal St., Chicago, Ill.

Dallas, Texas.

The Hart or Detroit

Emery Corundum Wheels and Machinery.



Write to J. WENDELL COLE, M. E.,

District Manager, Box 159, Chicago, Ill., or Box 84, Columbus, O.

N. B.—Also Agent for WM. SELLERS & CO.'S SPECIAL TOOL GRINDER and TWIST DRILL GRINDER WITH POINTER, for Pennsylvania, Ohio, Indiana, Illinois and Wisconsin.

Awarded the GRAND PRIZE at the Paris Exhibition.

SEND FOR THIS BOOK
FREE ON APPLICATION.
THE BABCOCK & WILCOX CO
WATER TUBE
30 CORTLANDT ST. N.Y.
21 BOTHWELL ST. GLASGOW, SCOTLAND.
BRANCH OFFICES
STEAM BOILERS
MANUFACTORIES IN UNITED STATES, SCOTLAND, FRANCE, GERMANY & AUSTRIA.

Cleveland Office, 412, Perry-Payne Building, Cleveland, O.

PENBERTHY AUTOMATIC INJECTOR.

Guaranteed 99 per cent. Efficiency

AS A BOILER FEEDER

42,000 in actual use.

Sent on 30 days' trial.

PENBERTHY INJECTOR COMPANY.,

Manufacturers,

DETROIT, - MICH.

C. H. PRESLEY, Agent, Cleveland, O.

GRAHAM TWIST DRILL CO., Detroit, Mich.,

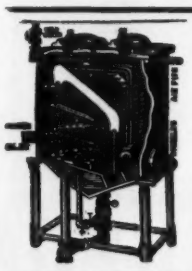
Sole manufacturers of **GRAHAM'S PATENT GROOVED SHANK TWIST DRILLS and CHUCKS.** Endorsed by progressive mechanics everywhere. Send for Catalogue.

AGENTS FOR THE GARVIN MACHINE CO.

And have in stock

SCREW MACHINES, TURRET LATHES, HAND LATHES, UNIVERSAL MILLING MACHINES, PLAIN MILLERS, TAPPING MACHINES (MOUNTED AND HEADS), UNIVERSAL CUTTER GRINDERS, ETC.

THE PARKIN & BOSWORTH CO., 8 S. Water St., CLEVELAND, O.



WEBSTER'S "VACUUM" EXHAUST STEAM ECONOMIZER,

Feed-Water Heater and Purifier

Is the most perfect device known for HEATING and PURIFYING the FEED-WATER for steam boilers, preventing scale, and for HEATING BUILDINGS of any description, WITHOUT BACK PRESSURE on engines, returning CONDENSATION to the BOILER IN THE ONE APPARATUS. Readily cleaned without stopping machinery. All parts accessible.

FURNISHED ON TRIAL FOR ACCEPTANCE.

Before you decide upon the adoption of any Feed-Water Heater and Purifier, or any device for assisting the circulation of steam for heating purposes, (after receiving full information of every device in the market) we would be pleased to call upon you personally (at our expense) and explain, with convincing proofs, the superiority of Webster's "Vacuum" Exhaust Steam Economizer over all pressure, coil, tubular or open heaters. Send for New Catalogue.

WARREN WEBSTER & CO., Prop'rs, 491 N. Third St., Phila.

74 Cortlandt St., New York. 159 La Salle St. Chicago, Ill.

PRESSED WROUGHT IRON OPEN TURN BUCKLES.

BEST AND Cheapest.

The list retail price of this Buckle is less than one-half the wholesale price of inferior goods when we commenced to manufacture, and dealers, even in small towns, find it profitable to carry a stock to sell with iron for tie rods

CLEVELAND CITY FORGE & IRON CO., CLEVELAND, OHIO.

Enterprise Boiler Company, YOUNGSTOWN, OHIO.

MANUFACTURERS OF

BOILERS, AND TANKS, SHEET IRON AND PLATE WORK

Of all Descriptions.

REYNOLDS BROS.,

MANUFACTURERS OF

Hand Cut Files

AND RASPS.

We solicit the commercial trade only.

133 & 135 N. Water St.,

COLUMBUS, OHIO.

Old Files Recut and Warranted Superior to any Machine Cut and Lead Tempered in the market. Send for price list.

TOLEDO

WIRE & IRON WORKS

Manufacturers of

Brass and Wire Railings,

Wire and Iron Fencing,

Roof resting,

Wire and Iron Window Guards,

Stable Fixtures,

And Builders' Wire and Iron Work of every Description.

F. POWELL & CO.,

TOLEDO, OHIO.

Jobbers of all kinds of **Roofing Materials.**

W. H. EBERTS ESTABLISHED 1871 J. M. EBERTS

EBERTS BROS.,

MANUFACTURERS OF

CORRUGATED IRON ROOFING, SIDING & CEILING.

OFFICE AND WORKS 192 TO 198 HIGH ST. WEST

DETROIT, MICH.

PRESSED STANDING SEAM, V Crimped and Roll Cap

IRON ROOFING.